PUBLISHED BY
THE W. J. JOHNSTON COMPANY, Limited,
Established 1874. Incorporated 1889.
168-177 POTTER BUILDING, NEW YORK.
W. J. JOHNSTON, President.
CLARENCE E. STUMP, Treas. and Business Manager.
Telephone Call: Murray 586. Cable Address: "Electrical," New York.

T. COMMERFORD MARTIN and JOS. WETZLER, M. E., Editors.
WM. A. ROSENBAUM, Editor Patent Department.
WALTER T. HUNT, Advertising Agent.

New England Office, { 8 Cook Building, cor. Congress and Franklin Streets, Boston.
W. I. BARKER, Manager.
Western Office, 44 Lakeside Building, Chicago.
E. L. POWERS, Manager.
Philadelphia Office, 31 City Trust Building.
E. F. CLARKE, Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.
(Including Postage in the U. S., Canada or Mexico.)
IN CLUBS of 4 or more the rate is $2.50 a year each; with a free extra copy to the getter up of a club of 8.
Subscription to foreign countries, $5 a year.
In requesting your address changed, give **old** *as well as new address.*

ESTABLISHED **FIFTEEN** YEARS AGO,
THE ELECTRICAL WORLD
IS THE PIONEER WEEKLY ELECTRICAL JOURNAL OF AMERICA, AND HAS WELL MAINTAINED ITS LEAD.
IT HAS THE LARGEST CIRCULATION
OF ANY ELECTRICAL PERIODICAL IN THE WORLD, AND IS
THE BEST ADVERTISING MEDIUM.
Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions. Quotations promptly furnished on application covering these points.
Correspondence, views and opinions on a topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News,** or information relating to any application of Electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned, unless accompanied by the necessary postage when received.
For Sale Notices, Situations or Help Wanted, $1 to $2 an issue.
Matter for the **Editorial** Department should be addressed to
The Editor of The Electrical World, New York.
Subscriptions and communications relating to **Advertising** or the **Business Department** should be addressed to
THE W. J. JOHNSTON COMPANY, Ltd.,
Potter Building, New York,
OR EITHER OF THE BRANCH OFFICES.

"THE ELECTRICIAN" IN THE UNITED STATES AND "THE ELECTRICAL WORLD" IN THE UNITED KINGDOM.
Arrangements have been made by which the London "Electrician" can be obtained from THE ELECTRICAL WORLD *office,* 168-177 *Potter Building, New York.*
The rate of subscription (payable in advance), including postage, is $6 *per annum to any address in the United States, Canada, Mexico or other foreign country.*
Single copies, price 10 *cents, can also be obtained at* THE ELECTRICAL WORLD *office. Similarly* THE ELECTRICAL WORLD *can be obtained in England at the office of* The Electrician, 1 *Salisbury Court, Fleet Street, London, E. C.*
The rate for English or foreign subscribers (payable in advance) £1. 1*s*

VOL. XIII. NEW YORK, FEB. 2, 1889. No. 5.

CONTENTS.

ILLUSTRATED ARTICLES: PAGE
Delany's New System of Automatic Telegraphy ... 54
The Perret Electric Motor ... 55
A Double Contact Vibrator ... 55
The New Weston Voltmeter ... 56
Electric Lighted Buoys in New York Harbor ... 57
The Sturtevant Engines for Electric Lighting ... 59
The Emerson Power Scale for Electrical Stations ... 61
Electric Tree Felling Machine ... 61
CORRESPONDENCE:
Motor Designing. By W. F. Collins ... 54
The Danger of Gas Mains as Electric Conducts. By A. R. P... 55
The Edison Convention at Kansas City. By J. H. Vail ... 56
Economy in Central Station Construction. By A. P. Wright.. 58
Some Railway and Battery Questions. By P. E. M. ... 58
Indicating Electric Heart Action. By R. H. M. ... 58
Hemp Sheathed Deep Sea Cables. By Capt. Samuel Trott ... 59
EDITORIAL:
Paragraphs ... 53
A New Electric Light Combination ... 53
MISCELLANEOUS:
Light without Heat. By E. G. Acheson ... 55
Gas Mains as Electric Conducts. By R. M. Hunter ... 55
Caustic Potash and Bromine Elements ... 59
An Hour in an Atlantic Cable Station ... 59
Abnormal Magnetism from Electric Discharges. By Prof. H. S. Carhart ... 60
On Induction from Ordinary Electricity and on the Oscillatory Discharge. By Prof. Joseph Henry ... 60
Executions by Electricity ... 60
The Effect on Electric Lighting of the Bate Decision ... 60
The Bate Refrigerating Company Decision by the United States Supreme Court ... 62
Another Sprague Road in the South ... 63
A Sprague Road for Atlantic City, N. J. ... 63
The National Electric Light Convention ... 63
A Presentation to Mr. W. J. Dealy ... 63
SPECIAL CORRESPONDENCE:
New York Notes, 63; New England Notes, 64; Philadelphia Notes, 64; Western Notes ... 64
DEPARTMENTS:
The Telegraph, 65; The Telephone, 65; The Electric Light, 65; Applications of Power, 65; Personals, 65; Miscellaneous Notes, 66; Business Notices ... 66
Our Illustrated Record of Electrical Patents ... 66

Automatic Telegraphy. THAT we have by no means seen the end of efforts made to increase the capacity of telegraph lines is evidenced by the descriptions of new systems which have recently appeared in our columns. In our last issue we described a system of synchronous telegraphy in which alternating current motors were employed as the medium of obtaining synchronism. In this issue the problem is attacked from another and not less ingenious standpoint, but more particularly from the "automatic" side. Mr. Delany's system is distinguished from those of a similar nature in that the Morse operator's duties remain the same, but each man is nevertheless constituted a perforator whose strip can then be transmitted at the rate of Wheatstone transmission. The system is well worthy of consideration and is evidently very simple.

Magnetization by Static Discharge. IN a recent note in these columns we took occasion to call into question the conclusion arrived at by Dr. Lodge, in which the abnormal magnetization of steel needles by the static discharge was cast under suspicion. In support of our remarks we cited the experiments of Prof. Joseph Henry on the same subject, and the false results which he at first obtained by the employment of thick needles instead of thin ones. In this issue Professor Carhart, writing on the same subject, gives the results of some of his own experiments in this line of investigation, which proved conclusively that abnormal magnetization does exist; and the method he employs is striking for its simplicity and effectiveness. In view of the interest which has been aroused in this subject, and at the request of a number of our readers, we reprint the part of Henry's writings relative to this subject, where the action by which abnormal magnetization is produced is most clearly and simply explained.

Electric Light Buoys. WHAT must be regarded as a most interesting and noteworthy departure in light-house and kindred practice is the recent inauguration of the electrically lighted buoys marking the entrance to New York harbor. The problem here to be solved was the uninterrupted maintenance of a number of lights at a distance of three miles from shore without the necessity of frequent visits of inspection or replenishing of the illuminant. There were evidently several methods to choose from, but after thoroughly considering the use of compressed gas, oil and similar illuminants, electricity was chosen as the most suitable of all. In an undertaking of such an entirely new character and one involving so many conditions differing from those obtaining in the practice of electric lighting on land, it is not to be wondered at that sundry innovations had to be made and that efficiency had of necessity to be sacrificed for the more important factor of reliable and uninterrupted service. Messrs. Mackenzie and Millis are entitled to praise and recognition as the devisers of a method or system which will without doubt find great extension both in this country and abroad.

Deep Sea Cables. IN reproducing last week from the Halifax, N. S., *Chronicle* the article of Judge Weatherbee on the subject of deep sea cables, we appear to have opened up a very important question for discussion and settlement. It will be remembered that Judge Weatherbee advocated in a very forcible manner the merits of "hemp sheathed" cables, as distinguished from iron covered cables, and presented a number of arguments in their favor. This week we are glad to print a letter from Capt. Samuel Trott, the veteran and well known expert in the cable laying and repairing service, on the points that have been raised. Captain Trott claims, as patented by himself and Mr. Hamilton, the electrician of his steamer, the type of cable described by Judge Weatherbee, and now that the matter has been given such publicity, he takes the opportunity to cite one or two of the reasons that recommend the cable for general adoption in submarine work. The reference made to the remarks of Prof. George Forbes, on the detrimental self-inductive effect of the iron sheath, is at once timely and pertinent, and the incidental note on the work that waits to be done in the tremendous depths of the Pacific Ocean, where the specific gravity of a cable must evidently be taken into account, shows that there is promise of other advantages in addition to greater speed of transmission. Our only regret is that Captain Trott does not feel himself at liberty to speak more fully out of his rich and ripe experience in this important department of telegraphy.

The Bate Patent Decision. WE print elsewhere in this issue the full text of the decision just rendered by the United States Supreme Court in the celebrated suit of the Bate Refrigerating Company against G. H. Hammond & Co. The point at issue in this suit was one of very great importance to electric lighting interests, affecting a large number of patents that were held to be void by limitation of the shortest term of like foreign patents. Several of Mr. Edison's leading patents, for example, were in this doubtful class of "suspects," and as the lower courts had already expressed opinions admitting the restrictive effect of foreign patents, it had naturally become the practice to regard all such patents as without effect. This decision, however, puts a new complexion on affairs, and while the patents affected have still to be tried on their merits, they must now be considered and dealt with as valid. The opinion of the court does not go so far as might be desired, perhaps, nor can we regard it as an exceptionally clear exposition of the law, but everything that tends to confirm an inventor in his rights is a great gain and cause for rejoicing, especially among electricians, whose whole art may be said to find its foundation and protection in patents. For a full appreciation of the scope of the decision we refer our readers to it as given on another page, and we may also call attention to the list of Edison patents, which we are informed will be favorably affected by the action of the court. It may be safely presumed that there are many other electrical patents of other inventors that will also be revivified, and either made immediately operative or put in position for direct adjudication on their merits.

Electric Measuring Instruments. IN the review of a recent work on electric measuring apparatus which appeared in our columns, attention was drawn to the author's remarks on the frequent inaccuracy and variability of instruments intended for every day practical use. As pointed out, manufacturers of such instruments do not as a rule take the trouble even to calibrate their instruments, with the result of irregularity in service, and sometimes actual loss, when the indications of such instruments are relied upon. In considering this question, Mr. Edward Weston has attacked the problem of constructing electric measuring instruments which shall, under the ordinary conditions of use, be accurate in the first place, and remain so during continued employment. The selection of the permanent magnet for this purpose by Mr. Weston may at first be considered a step of doubtful wisdom; but, as remarked in another column, it is well known that magnets after use for some time become quite fixed in their magnetic state, and thereafter their indications can be relied upon with every confidence. It will be noted that provision has been made for this by giving the magnets an artificial ageing, and another factor of not less importance has been introduced in the shape of the fixed iron core of the indicating coil, which maintains the strength of the field as uniform as possible, and approaches very nearly the condition of the closed magnetic circuit. It will also be observed that the instruments are made of very high resistance, so that the temperature correction is not required, and the means are afforded within the instrument for verifying its accuracy at all times. The entire construction of the apparatus shows much thought, and the experiments which we have ourselves witnessed as regards its delicacy of action speak volumes for an instrument designed for practical use such as this one is.

A NEW ELECTRIC LIGHT COMBINATION.

One of the most important pieces of news that we have to publish this week is that relating to the arrangement made by the Westinghouse and United States electric lighting companies. Rumors as to the intention of the United States Company, which has hitherto maintained its entire independence, to join hands with one or another of the large companies, have been current for a week or two past. In Boston it was reported that the compact would be with the Thomson-Houston Company, while in New York the conjecture was that it would be with the Westinghouse Company; and there were not wanting signs to prove the accuracy of the latter surmise. It is now officially announced that the agreement arrived at between the Westinghouse and United States companies is upon a basis of joint patent litigation and of manufacturing co-operation; and it is further understood that in return for a guarantee upon the United States stock up to a certain amount the Westinghouse Company assumes the control of the whole of the United States Company's business.

It will be seen that this is an important combination. While the United States Company has not had the reputation of being a very profitable concern to those interested, it has always held a commanding position in the electric light field, as well from the fact that it was one of the oldest organizations as from the magnitude of its operations and the number and value of its patents and plants. And now that a property of such age and reputation has fallen into the vigorous hands that hold the Westinghouse interests, it is clear that a strong combination is the result of the transfer. At the present time, in addition to its control of the United States system, the Westinghouse Company has practical ownership of the Sawyer-Man Electric Light Company, the Consolidated Electric Light Company, the Waterhouse Electric and Manufacturing Company and the Tesla Electric Lighting Company, placing it in the forefront of the companies that now dominate the situation. It will readily be believed that under such circumstances there will be no diminution in the aggressiveness that has marked the Westinghouse policy, but that greater energy than ever will be shown in developing the immense territory still to be furnished with millions of electric lights, motors and railways.

We learn that the capital represented by the combination in its present shape reaches no less a sum than $10,000,000. The combined factories have, it is said, a capacity of not less than 16,000 lamps per day, with equivalent apparatus for new installations. There are a large number of plants and stations already in existence under the new management which in themselves offer a large income on their lamp renewals and extensions, and it is stated that it has already been determined to increase the output.

Delany's New System of Automatic Telegraphy.

It is now generally recognized that the day of "single circuit to a wire" telegraphy has gone by, and that only multiplex or machine telegraphy can be commercially successful on a large scale, In England, which, outside of our own country, is the most progressive in telegraphy and all other branches of electricity, the large volume of business, traffic and news matter handled has for several years forced upon the government service the extensive use of machine telegraphy; and it is there that the Wheatstone system has reached its highest development. Not many years ago this admirable system was only capable of less than 100 words per minute. Within the past year, Mr. Preece, the able "progressist" in English telegraphy, has had the satisfaction of witnessing a speed of 400 words per minute between

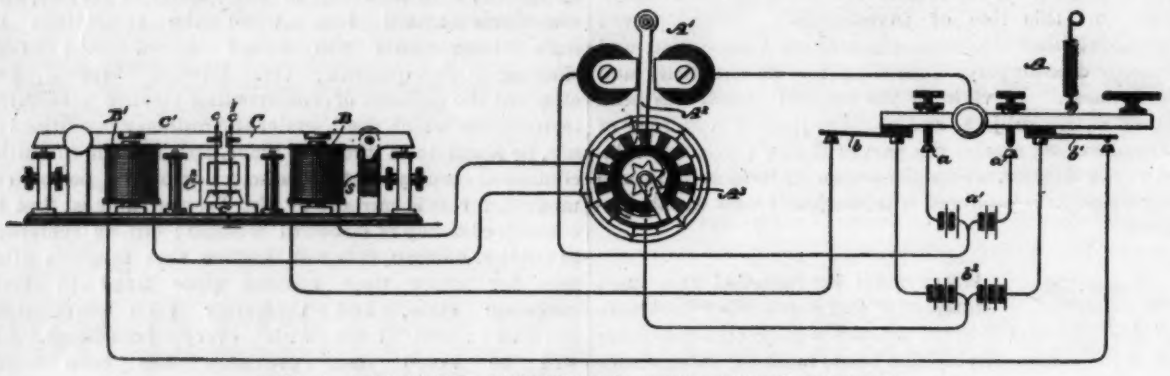
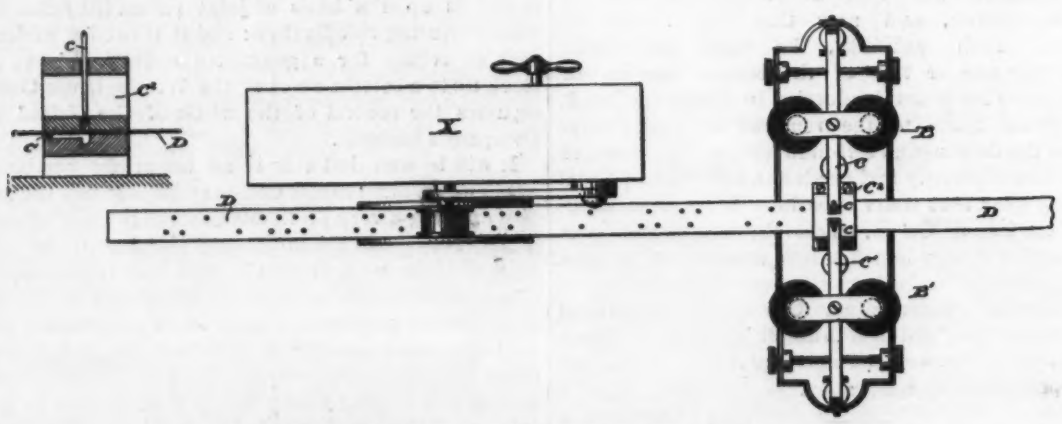


FIG. 1.—DELANY'S AUTOMATIC TELEGRAPH SYSTEM.

London and Belfast, and 600 words per minute on shorter circuits in the United Kingdom, the received record being made in ink and on dry paper. This performance goes to show the wonderful development of the polarized relay, which is the keystone of all English systems. Greater speeds than this have been obtained in this country by the chemical process of reception, but the use of chemically prepared paper is on many accounts undesirable.

The chief objection to machine telegraphy has been the preparation of the messages. Since the time of Alexander Bain numerous ingenious devices have been brought forward for punching the strip of paper which forms the stencil or matrix from which transmission is accomplished, but all have been more or less complicated, expensive, and, owing to mechanical intricacies, unreliable. Besides, nearly as much practice and experience was required for their operation as was necessary to master the art of Morse telegraphy itself; so that even now in this country, where the Wheatstone system has become an absolute necessity, special operators are required, it being impracticable to combine the Morse and Wheatstone systems so that both can be worked by the same operators. This is largely owing to prejudice on the part of the Morse operators, who have considered the punching process beneath them. Notwithstanding these obstacles, the growth of telegraphy in this country has compelled the introduction of the machine system, and at the present time the Wheatstone plan is being extended on the Western Union



FIGS. 2 AND 3.—DELANY'S AUTOMATIC TELEGRAPH SYSTEM.

Company's lines over the most important routes of traffic. In order to meet the demand for a system of machine telegraphy which shall obviate the difficulties above pointed out and yet be of such simplicity as to be operated by the ordinary Morse operator, Mr. P. B. Delany, whose past work in the field of telegraphy is well known to our readers, has recently devised a system which appears to be eminently practical and possesses a number of novel features.

The main feature of Mr. Delany's invention lies in the preparation of the message for transmission, and this will be readily apparent when it is understood that the punching mechanism is controlled by the manipulation of an ordinary Morse key, so that any Morse operator may transfer a message to the sending strip of paper with the same facility and ease employed in sending a message over the wire in the usual way. In fact, the operation is exactly the same. Every Morse operator can perforate, and it is immaterial to him whether his key be connected to a wire leading to a distant city, or to one attached to the simple machine which punches the paper strip.

We cannot present here all the details of this system, but must confine ourselves to the main features, viz.; the preparation and transmission of the message. The dispatch may be received on a regular Wheatstone record in dots and dashes, and the speed of Mr. Delany's system should be quite as great as that of the Wheatstone. In the accompanying illustrations, Fig. 1 shows the perforating machine. A is a Morse key with front and back contacts a, a, through which the circuit of a split local battery a^1 containing the coils of a polarized circuit changer A^1 is completed alternately from opposite poles as the key is pressed down and raised. The armature A^2 of the polarized circuit changer is provided with pallets, engaging the teeth of a star wheel on a spindle carrying a trailer, which is caused to travel over a circle of insulated segments A^3, as the armature moves in obedience to the manipulations of the Morse key. The key has also front and back yielding contacts b b^1, each connected with one pole of a split battery b^2, the middle of which is connected with the trailer on the table of contacts A^3. The stops against which the yielding contacts b b^1 work are respectively connected through magnets B or B^1 with the alternate segments of the circle A^3.

Now if the key A be pressed down, the circuit of magnet B^1 will be completed through the key contact b^1 and the segment on which the trailer then rests before the closing of the circuit of the polarized circuit changer A^1 through the front contact a, and before the trailer moves to the next segment, which is in the circuit of the other magnet B. In like manner on raising the key the circuit of magnet B will be completed. Thus it will be seen that when the key is operated the magnets B^1 B are closed alternately, but only for a moment, regardless of the time for which the key is held in the up or down position. The circuit through either magnet is no sooner made than it is broken again in a single movement of the key.

The levers of magnets B B^1 have puncturing rods c c loosely attached to their ends, which punch holes in the paper strip in response to the movement of the key. Thus two rows of holes are made, as shown in the plan view, Fig. 2. The strip is continuously drawn by clockwork X through the guide block C^2, of which Fig. 3 is a sectional view, through one of the puncturing pins c. Under these puncturing rods are holes to receive the points after passing through the paper strip. From these holes to the front of the guide block are channels c^1 to admit of the passage of the burr formed on the under side of the paper, so that the strip will move smoothly.

The paper receives but a momentary check in its movement while a punching rod is passing through it. A dot is represented by two holes in the paper nearly opposite each other. This obliqueness represents the time between the closing and opening of the key. Thus, if the lower line of dots at D be made by pressing down the key, the top line will represent the opening or back contact of the key, and if the letter A in Morse characters be made on the key, the dot of the A will be represented by the two dots almost in line, while the two that are at a greater angle denote the dash. The strip in front of the roller wheel shows a dot followed by a dash, then a space, then a dash and three dots; again a space, then two dots, space and a dot; that is, the letters "A," "B," "C." The rapidity with which these characters may be punctured in the paper is only limited by the expertness of the Morse operator.

The transmitter T is shown in Fig. 4, of which Fig. 5 is a plan view showing the contacts. The strip is passed over a roller T^1 having two grooves corresponding to the two lines of holes in the paper. On top of the strip, and each in line with a row of holes, are two pivoted fingers e e which fall into the holes in the paper. The pressure of these fingers on the strip is regulated by springs e^1. The fingers are both connected to the line, Fig. 5, and their vertical extensions move between stops f f, g g; f f are the poles of the main battery M B. When finger e drops into a hole it makes contact with the positive pole of the main battery at f. The other finger, in like manner, makes contact with the negative pole of the battery. It will be seen that as the fingers can only drop in alternately, the impulses sent over the line alternate in polarity, and that each impulse is a dot and of the same duration.

The polarized relay P R, which represents a Wheatstone recorder at the receiving station, Fig. 5, will re-

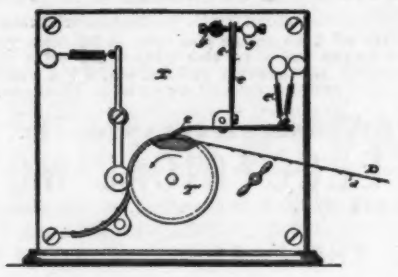


FIG. 4.

spond to these reversals. If the left hand stop of the polarized relay represents the open or spacing side, and the right hand side the closed or marking side, it follows that when a finger drops into a hole in the strip and comes in contact with, say, the positive pole of the battery, the armature of the polarized relay will be thrown to its right hand stop, and will remain there until the other finger sends a negative impulse to throw it back again. If, therefore, a positive and negative follow each other in quick succession, the receiving recorder marks a dot on the strip. If there be a little delay between the positive and negative current a dash will be recorded. Delay between a negative and positive denotes a space. Consequently the three first letters on the strip D, Fig. 2, representing "A, B, C," would be shown on the received strip, thus: ·— —··· ··—·.

It will be observed that in transmission the electrical contact is not made through the holes in the paper, as is the case in all other machine systems except the Wheatstone. Lubricated and frictional contacts are avoided, nor can the contacts be impaired by films of paper in the holes.

The system here shown presents several important advantages, principal among which may be noted its adapt-

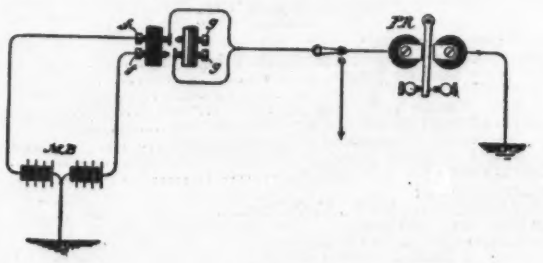


FIG. 5.

ability to the Morse operator without further instruction or practice of any kind, and the great facility with which a strip may be punctured. To cut a piece out of a strip requires power and precision of mechanism constantly requiring repairs.

Another important consideration from a commercial standpoint is the cheapness of the perforating paper. While the Wheatstone requires specially manufactured and very expensive paper the new system operates equally well with the common cheap tape now used on stock "tickers."

Motor Designing.

To the Editor of The Electrical World:

SIR: In your issue of November 17, 1888, I noticed an article on "Designing Motors and Dynamos," by R. B. Owens, in which he states that the area or cross section M of a magnet core 7 inches in diameter is $\pi \times 7^2 = 155.46$ square inches. Now, the area of a circle $a = \frac{\pi d^2}{4}$. Therefore the area of a circle 7 inches in diameter $= \frac{\pi \times 49}{4} = 38.4846$ square inches, which is the correct cross section of this magnet core.

BOSTON, Mass., Jan. 23. W. FORMAN COLLINS.

A Double Contact Vibrator.

The accompanying illustration shows an arrangement for vibrating bells and similar apparatus, which was recently described in the *Annales Telegraphiques*, and which is claimed to possess the advantage of suppressing the sparks at the contact, so-called, at the moment of rupturing the circuit, and in transferring the spark to a pair of auxiliary contacts whose good and bad condition is of no importance in the operation of the apparatus. As will be seen, the spring *r* follows the armature during an instant when the former is attracted. Thus the breaking spark takes place for the most part between the spring *r* and the armature, so that the contact between the other face of *r* and the screw *V* remains in good condition. This apparatus has been employed in particular for the telephone service in Paris, in connection with the Ruhmkorff coils used for calling generators on long lines, and has given very good results. It would seem to possess some advantages over the employment of the shunt, condenser or voltameter placed in shunt around vibrating contacts.

The Perret Electric Motor.

It is well-known that it is more difficult to build small electric motors of high efficiency and automatic regulation than large ones. Recognizing this difficulty, Mr. Frank A. Perret, electrician of The Elektron Manufacturing Company, of this city, has designed an electric motor with special reference to obtaining high efficiency and close regulation in the smaller sizes.

The first of these motors were constructed in 1886, and though somewhat crude as compared with those now manufactured, they nevertheless showed good results. Since then, much thought and experiment have been devoted to their improvement, especially in the introduction of new methods, by which the cost of manufacture is largely reduced.

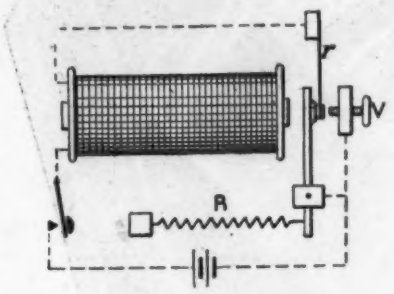
The motors are designed to be run on constant potential, incandescent light or power, circuits, and are usually wound for 110 volts. They are at present built in six sizes, from ⅛ h. p. up, and their general form is shown in our illustrations, Figs. 1 and 2, which represent respectively the ¼ and ½ h. p. motors. The smallest of these is said to have a commercial efficiency of over 70 per cent., while in the larger sizes, such as the 1½ h. p., it reaches over 90 per cent. This excellent performance is due largely to the lamination of the field magnets.

The great advantages of this construction have been generally recognized, but it has not been largely adopted, heretofore, in motors or dynamos, because of the expense which it involved. As will be seen in Fig. 3, the magnet core is made of thin plates of soft refined sheet iron of the highest magnetic permeability, which are placed in planes at right angles to the armature shaft. All wasteful induced currents are thus prevented and a magnetic circuit of the best character is secured. The armature core is also laminated and carefully insulated, and where, as in the smaller sizes, economy of space is very important, the wire is covered with two layers of silk, which gives the best insulation in the smallest space.

The constant speed motors have the simple shunt winding, which, with armatures of very low internal resistance, gives close and automatic regulation, together with high efficiency and without the use of a mechanical governor. The internal resistance of the armature has been reduced to a very small amount, the armature of the ¼ h. p. 110 volt motor having only 11 ohms resistance. The shunt resistance of this motor is about 450 ohms. The field magnet and armature are so proportioned that the brushes have no lead and do not require shifting with changes of load; hence the usual rocker arm is entirely done away with.

The mechanical details of these motors have also been well worked out. The bearings are all accurately fitted and are very long in proportion to their diameter. On the two smallest sizes they are of hard composition, and in the larger sizes of Babbit metal. The shafts are all of steel, ground on dead centres.

The armatures employed are of the drum type, as shown in Fig, 4, and are perfectly balanced. The commutators are constructed of hard bronze carefully insulated, and this, together with the permanent position of the neutral point caused by the lamination of the field magnets, avoids all sparking and wear at that point. The armature is so supported that perfect alignment with the field magnet is always secured regardless of variations in the iron plates,



DOUBLE CONTACT VIBRATOR.

and the armature may, in one moment, be removed, if desired, and replaced again. We may add that these machines can, with equal advantage, be used as either motors or dynamos.

Light Without Heat.

BY E. G. ACHESON.

In THE ELECTRICAL WORLD of Jan. 26 there is a letter from Mr. A. B. Worth, and an editorial on the subject of the production of *light without heat*.

The care Mr. Worth has very properly taken, in making his statements, leaves the question as to the methods he is following rather uncertain. And while he may be working on perfectly original lines, it is possible he is tilling old ground; not only old experimentally, but actually covered by United States letters patent.

In this letter the production of light from polarized light introduced into an electric circuit, and acted upon by oscillating or alternating electric currents is mentioned. It is self-evident that some other source of energy than light must be used, from which the required energy is drawn, and it is more than probable Mr. Worth is utilizing the heat waves produced by chemical action as the source of his light waves. The character of the energy remains, however, the same, the rates of vibration being their distinguishing feature.

Acting upon a light wave by a changing electric current is equivalent to acting upon it with changing lines of magnetic force, and light waves being identical with heat waves (excepting rate of vibration), the process or method is equivalent to acting upon heat waves with changing lines of magnetic force.

In a communication to THE ELECTRICAL WORLD, published March 25, 1887, I attempted to outline a theory relating to light, heat, electricity and magnetism, and which was the basis of very extensive experimental work. Any who may have read that communication will remember that the theory assumed the modes of motion of electrical and heat energy to be identical. Later experiments and researches by Dr. Hertz and others have demonstrated the accuracy of these views.

With these various data before us it will be recognized that a patent such as was issued to me December, 1887 (calectric generator), on the production of electric currents from heat energy, by causing the heat to enter an electric conductor and therein acting upon it by changing lines of magnetic force, will fully cover the production of electric energy, even up to such rapidity of oscillations as have been found necessary for light waves.

There is, I think, no doubt but that this is the method by which energy will be caused to pass from point of production to point of consumption, and that, too, in the near future.

My object in drawing attention to this case, is not to discourage Mr. Worth, or any others, from pursuing these experiments, but rather to prevent a waste of time and money devoted to applications for patents on these oscillatory motions that are even now broadly covered, and which form the basis of continual experimental work and researches.

The Danger of Gas Mains as Electric Conduits.

To the Editor of The Electrical World:

SIR: In your issue of Dec. 22, 1888, you had a cut of a gas main used as an electric light wire conduit. In your issue of Dec. 29 I pointed out the danger, as I thought, of such a plan. In your issue of Jan. 5, 1889, your correspondent "B." (and you said others wrote in the same tone) laughed at my ideas. With all due respect to "B.," I think recent events in Reading, Pa.; Nassau street, New York; Brooklyn, N. Y., and also cases noted in *Light, Heat and Power*, pages 83 and 85, of Jan. 17, exonerate me from being an alarmist.

"B." claims that gas to explode needs an admixture of air. So it does; but my idea was that a fracture would occur before any danger would manifest itself, and in that event it would be present. And, indeed, I do not think any conduit could be made air tight; and if an explosion can occur, which is often the case, from electric wires igniting the escaped gas in the ground from leaky pipes, it certainly can occur from leaks in a gas main with a broken or defective electric light wire in it. Would you, sir, run this risk in large cities? I would not.

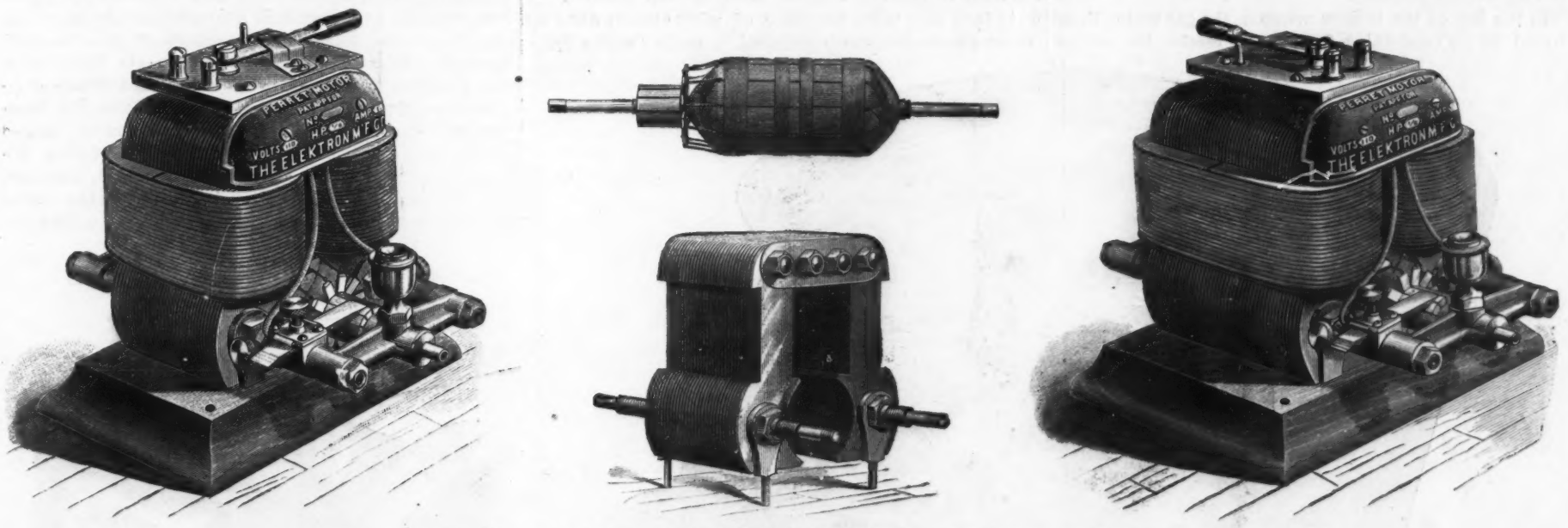
A. R. P.

Gas Mains as Electric Conduits.

BY R. M. HUNTER, M. E.

I noticed to-day the letter of "A. R. P." in THE ELECTRICAL WORLD of Dec. 29, 1888, under the heading of "The Danger of Gas Mains as Electric Conduits." As so few people understand the characteristics of illuminating gas, I think it might be well to state, in reply to the suggestion of the possibility of explosion in the gas main by a breaking wire suspended within the main made by "A. R. P.," that the composition of gas as it exists in the gas holders and city mains *is not an explosive mixture*, and that an arc or flame, if formed within such a main, would be *instantly extinguished* by the gas.

The editorial which appeared on the subject in the issue of Jan. 5, 1889, would not be understood by a large majority of the readers. It assumes that illuminating gas is a hydro-carbon gas, without stating that it is a complex mixture of many gases, according to the process under which it is made; that is to say, whether it is water gas, oil and water gas, wood oil gas, or from the destructive distillation of coal. In the manufacture of the first three of these gases no air is admitted to the gas before going to the holder or the mains; whereas, in the manufacture of the latter gas, air is admitted, and I have known it to be used as a dilutant to such an extent as to extinguish the lights of a large city without producing an explosion from any of the million of burners which were burning. On the other hand, I have known a case where the entire city mains of an oil and water gas plant were destroyed by an explosion caused by a foolish ignition of a burner when the gas was first turned on the mains and was in the act of driving out the air. It requires a given quantity of air in any case to render the gas explosive, and if it was of an explosive nature as it exists in the main, then the first burner lighted would cause the ex-



FIGS. 1, 2, 3 AND 4.—THE PERRET CONSTANT POTENTIAL MOTOR.

plosion without waiting for the breaking of the electric wire. I do not see how the carbon would be deposited and bridge the break in the wire, as stated by the correspondent referred to in the editorial, as the break would separate the wires many inches under almost any conditions; and, since the ends would lie in the gas liquor in the bottom of the main, the current might pass or be grounded, but no continuation of the arc could ensue. The flashing process in making incandescent lamp filaments has nothing in common with what would take place in the case of a breaking wire in a gas main. In that case the filament is a conductor, and is carbonized in a non-oxidizing medium, which when formed of a hydrocarbon gas has the advantage of cheapness, quick manipulation and improvement in the surface qualities of the carbonized filament.

In the case of the broken wire on the gas main, there would be no conducting filament to receive the carbon deposition, and the flash would be but for an instant, in any event, and could not decompose any appreciable quantity of the gaseous mixture to cause any such accumulation as implied.

The Edison Convention at Kansas City.

To the Editor of The Electrical World:

SIR: The next semi-annual convention of the Association of Edison Illuminating Companies will be held at Kansas City, Mo., on Tuesday, Feb. 12.

Accommodations have been arranged for the members of the association at the Coates House, Kansas City.

NEW YORK, Jan. 25. J. H. VAIL, Secretary.

The New Weston Voltmeter.

It is a law of human progress, nowhere better exemplified than in the industrial and mechanic arts, that all systematic and permanent advance depends upon our ability to determine quantitatively, in terms of some standard, the value of the various factors involved in any given operation or transformation. An idea of the crudeness of men's notions of measurement in former times as compared with the present, may be gained from the names of units or standards which have been handed down to us. Thus three barley-corns made one inch; the foot was the length of the king's pedal extremity; the hand is a measure still in use in estimating the height of horses, etc. Compare such notions with the accuracy required in modern machine-shop practice. It is, in fact, only when the value of work already done becomes known that one is prepared to make further progress, as every step in advance demands increased refinement in the means and methods of measurement. As an instance in point, witness the mutual development of the steam engine and the steam engine indicator. Just as the indicator has advanced to a state of perfection, such that its records are universally relied upon, not only to detect faults in present apparatus, and intelligently outline the direction of improvement, so has there been a gradual advance in the construction of commercial electrical measuring instruments, serving a similar purpose, and tending to effect a similar result, in electrical engineering. While it is true that thousands of engines are never indicated, and thousands of electrical appliances are never carefully tested, it is equally true, as a consequence, th useful energy is wasted, property destroyed and money lost.

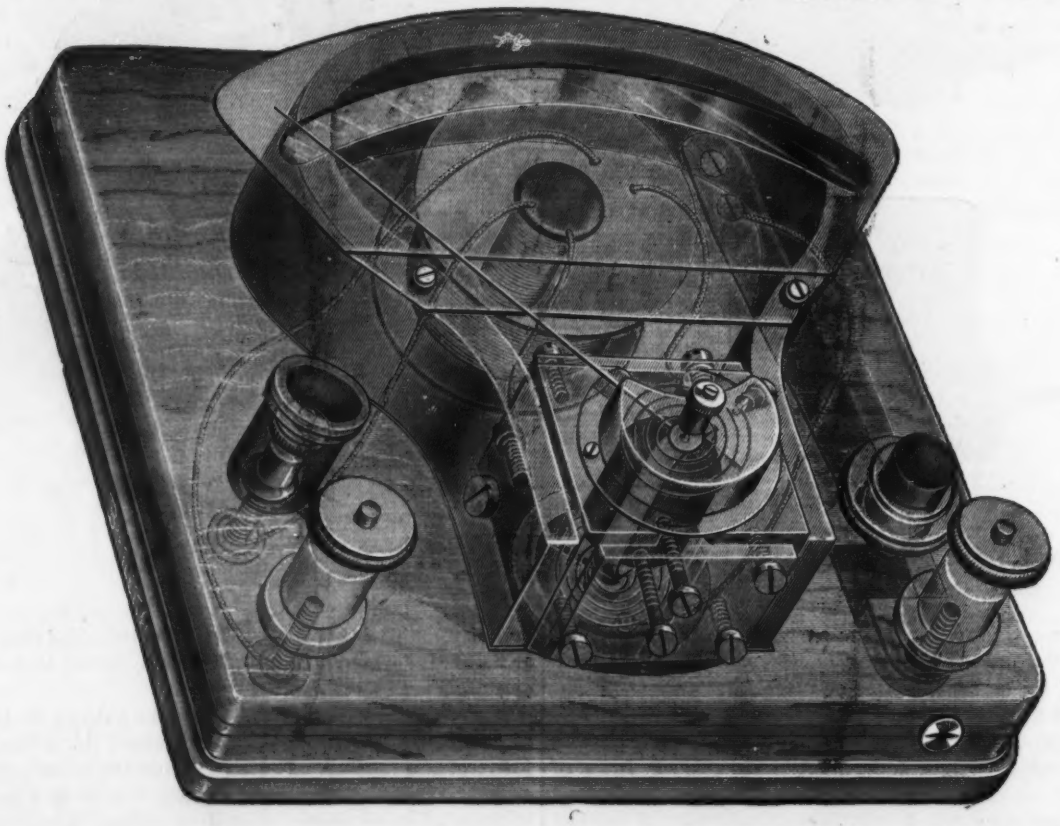
In electrical as well as in mechanical engineering, success necessitates the elimination of guess work and the substitution of knowledge. Engines, dynamos, batteries, electric motors and lamps, are sold with a guaranteed efficiency and life, subject, however, to definite conditions as to use. It is generally because of the absence of definite knowledge as to when the imposed conditions are actually observed, that losses so frequently exceed profits. When measurements of the value of electrical appliances are actually made, the results are often discredited because of doubt as to the accuracy of the instruments used, and probably the general indifference to accurate work manifested by many electricians may be justly ascribed to the absence of reliable measuring instruments.

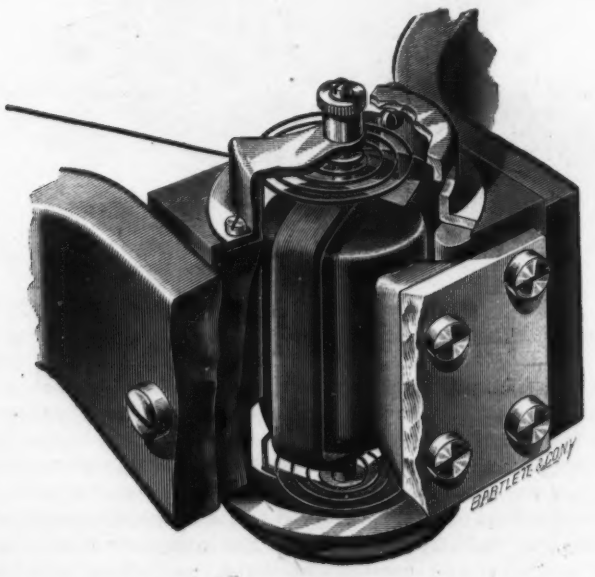
Most of the commercial electrical measuring instruments in use in this country to-day are of foreign manufacture. They may be briefly described as either of the permanent or electro magnet type. The former are in general disfavor, and unjustly so, because their defects are not inherent in the types, but are, rather, the natural result of poor design and construction. Those who have had much experience with these instruments, of which the Deprez and Ayrton & Perry are examples, will recognize the fact that while these instruments are new, they were subject to rapid and serious changes in their constant. The rate of change, however, diminished with age and use, up to a certain period, when they assume a condition of stability, and are thenceforth, in so far as the controlling force is concerned, reasonably reliable. Uncertainty as to when this condition of stability is attained necessitates frequent calibration, and is thus a serious obstacle to accurate work. A second defect is the heating error introduced when the instruments are kept in circuit even for the short time necessary to make readings.

Instruments of the electro-magnet type are, on the other hand, more generally in demand, because of the prevalent idea that they are not subject to errors arising from a variable controlling force. Errors, however, fully as serious as have been ascribed to permanent magnets, are not only common, but seemingly inherent in this type, because of the magnetic persistency of the softest iron, even when subdivided. This error is most noticeable when readings are made with a rising, succeeded by a falling current, and often amounts to as much as twenty-five or thirty per cent. The best forms of this type of instrument are, perhaps, the ingenious spring voltmeters and ammeters of Ayrton & Perry. These are, however, subject to serious heating and frictional errors.

Thus far we have mentioned only the most glaring defects common to commercial instruments. Another, and almost universal defect is due to inaccuracies in the reading-scale. A great advance was certainly made when direct-reading instruments were substituted for those requiring a multiplying constant. It is a notable fact, however, that most of the direct-reading instruments, judged by the uniformity of their scale-divisions, follow the proportional law. This is extremely doubtful, however, and calibration generally reveals the fact that seldom are there more than two or three of the scale marks cor-

FIG. 1.—THE WESTON VOLTMETER.





FIGS. 2 AND 3.—THE WESTON VOLTMETER.

rect. Printed or engraved scales may justly excite suspicion as to their accuracy.

The advent of an improved type of commercial electrical measuring instruments for direct current circuits, in which the sources of error enumerated above are practically eliminated, and which are equally well adapted for both laboratory standards and commercial service, is justly to be regarded as an important step in the development of electrical instruments. The Weston Electrical Instrument Company, of Newark, New Jersey, have recently placed upon the market a new form of commercial voltmeter and ammeter, designed by Mr. Edward Weston the well-known electrician. The especial aim in designing these instruments has been not only to entirely

eliminate such variable factors as have been enumerated above, but to add to the instrument certain valuable features mentioned below. To this end, the electrical, magnetic and mechanical details have been so worked out as to insure permanence and reliability, coupled with simplicity, extreme accuracy, a wide range of scale reading and portability. The accompanying engravings, Figs. 1, 2 and 3, give general and detailed views of the voltmeter. It will be seen that the field of force is produced by a permanent magnet of peculiar form, while the deflecting body, carrying the index, is a light coil of insulated wire, whose motion, resulting from the dual fields established by the magnet and current circulating in the coil, is restrained by two coiled springs. The springs serve also to convey the current into and out of the moving coil, as explained in our issue of November 17, 1888.

That permanent magnets can be, and in fact are, daily made which, after undergoing a process of artificial ageing, remain thenceforth practically constant in strength when subject to ordinary use, is now generally acknowledged. In these instruments special care has been taken not only in the selection of steel and its proper magnetization and artificial ageing, but the magnetic resistance of the acting field has been reduced to its lowest practical limit by the insertion of a central core of soft iron within the movable coil. This core is supported upon the magnet frame by a strap of diamagnetic material. The form of the pole-pieces is such that the deflecting coil constantly moves in a uniform field, and hence the deflections practically follow the proportional law, and a direct reading scale, of nearly equal subdivisions, is obtained. The movable coil is wound upon a light frame of copper, which serves the double purpose of a support, and also, since it moves in an intense field of force, as a damper, thus making the instrument exceedingly dead-beat. All of the important parts of the instrument are made to gauge, and the bearings of the deflecting coil are jeweled; interchangeability of parts, and the elimination of friction, is thus obtained. A difference of potential of about one and one-quarter volts, at the terminals of the movable coil, serves to deflect the index over the entire scale, the length of the scale being about six inches. This degree of sensitiveness permits, therefore, the construction of instruments having a wide range of maximum scale-reading by the simple insertion of differentially-wound resistance coils in series with the movable coil.

Figs. 1 and 2 exhibit the external and internal parts respectively of the new voltmeter, having a scale of double values, with a ratio of 20. The scale divisions for the upper values, Fig. 1, read single volts, while for the lower values they read one-twentieth of a volt. The single divisions are of such a size that one can easily read to one-tenth of a division, namely, to one-tenth of a volt on the upper values and one two-hundredth of a volt on the lower. This form and ratio of scale values is useful for battery work, and especially for storage batteries. The lower scale values are used when examining single cells, or sets of two; and the upper scale values when measuring the aggregate potential difference of a series of cells. In the former case, connection is made with the small binding-post (under the rubber cap) on the left, and with the larger binding-post on the right. In the latter case, connection is made with the two large binding-posts.

Another very important feature is the means afforded those not in possession of laboratory appliances of verifying the scale value by applying a single cell of some constant form, such as is to be found in any telegraph office, to the terminals of the coil giving the lower scale reading. The deflection noted serves as a standard for future comparison with the same or a similar cell, should doubt arise as to the effect of accidental rough usage.

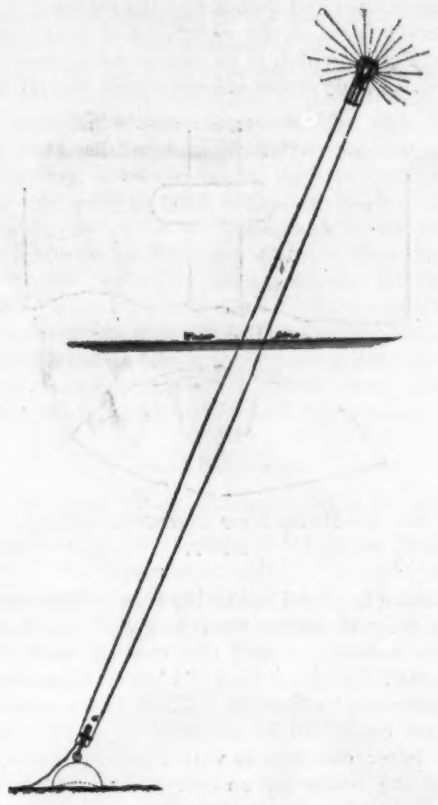


FIG. 2.—SPAR BUOY WITH LAMP.

All scale readings begin at zero, and extend by practically uniform increments to the maximum reading. The range of scale readings for instruments of a given maximum scale is thus greater than is common, and as the divisions of each scale are the result of individual calibration and checking, the scale readings are uniformly accurate. The temperature correction is negligible, and the instruments can be kept constantly in circuit, as their resistance is so high (averaging twenty thousand ohms) as to prevent any appreciable heating error. The ammeters have the same general appearance as the voltmeters, and possess the same merits of permanency and reliability.

In the hands of electricians and electrical engineers, these instruments are claimed to afford the means of obtaining measurements correct to within one-fifth of one per cent., and special instruments are made correct to within one-tenth of one per cent. If the limits of error were even ten times as great as claimed, these instruments would, it is said, possess greater accuracy than has been heretofore attainable in commercial voltmeters and ammeters. It is most certainly to be hoped that actual practice will substantiate the accuracy of these claims.

Electric Lighted Buoys in New York Harbor.

New York Harbor, though acknowledged to be one of the finest in the world, was, until recently, closed at night to ships of deep draught, such as most of our Atlantic liners now are. For, although the channel taken by day, and known as Gedney's, afforded sufficient depth of water and is well marked with buoys, clearly discernible during the day time, at night the range light are frequently obscured, even in moderately clear weather, so that ships of very deep draught were frequently obliged to lay to outside for six hours and more, which evidently meant considerable delay and expense to a steamer which had crossed the ocean in six days. To overcome this difficulty by employing lighted buoys to guide mariners at night has been the subject of much consideration, and, after carefully weighing the advantages and disadvantages of the various systems, it was finally decided by the Light-House Board to adopt the electric light as the most practicable form, and the method agreed upon was the operation of an incandescent lamp of high power fed by a current generated on shore, and conveyed through a cable laid on the bottom of the sea. This work was put in charge of Lieut. Commander M. R. S. Mackenzie, U. S. N., and First Lieut. John Millis, Corps of Engineers, U. S. A., and in their report to the Light-House Board just published we find an admirable description of the methods employed in this entirely original piece of work.

Our illustration, Fig. 1, is a map of the outer portion of New York Harbor, and shows the location of the buoy lights and the channel which they mark. The lights, as designated, are colored red and white on either side of the channel and give a clear course for ships entering the harbor at night.

The details of the system here employed are highly interesting, and merit some description on account of the novel and successful methods employed.

One of the electric spar buoys which marks the channel is shown compete in our engraving, Fig 2. The buoys are made of a species of juniper which grows in the Dismal Swamp of Virginia, this timber being selected on account of its buoyancy and straightness of growth. The spars average about 45 feet in length, 10 inches in diameter at the butt, 15½ inches on the largest section and 11 inches at the top. They are shackled at the bottom to a hemispherical cast-iron sinker weighing 4,500 pounds. To the top of the buoy is firmly screwed the protecting cage, which is composed of flat iron ribs riveted to two iron bands,

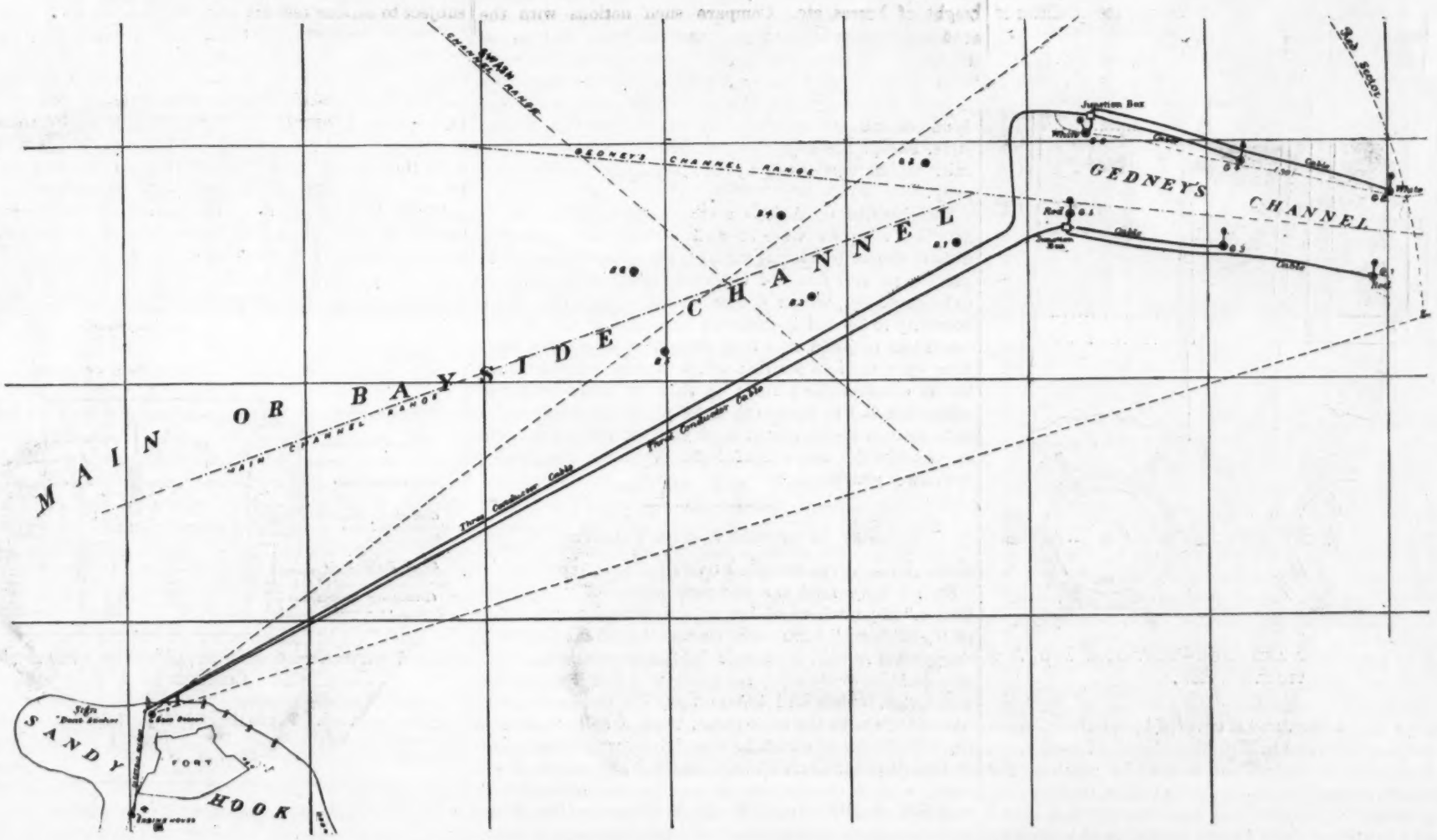


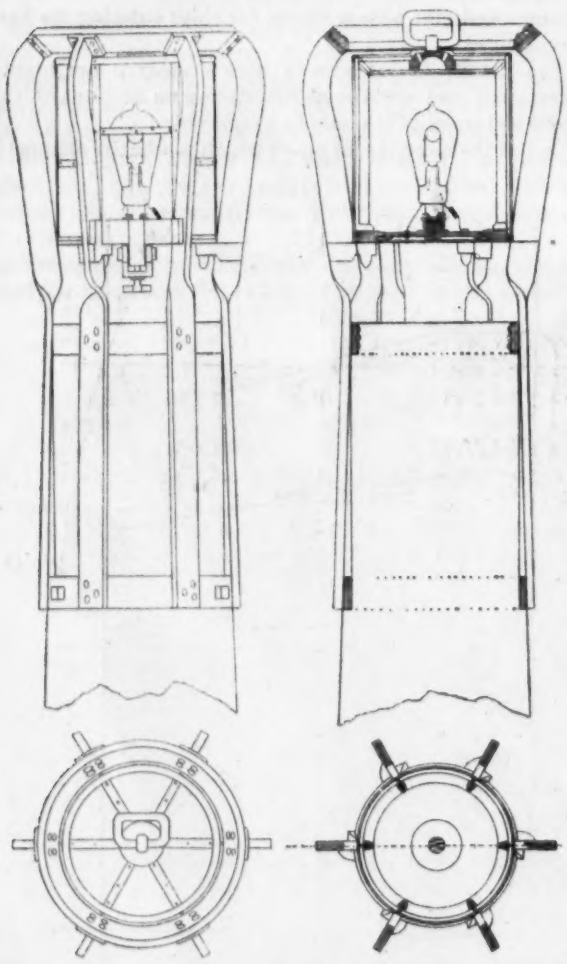
FIG. 1.—GEDNEY'S CHANNEL, NEW YORK HARBOR, LIGHTED BY ELECTRIC BUOYS.

which encircle the spar with a third ring at the top of the cage. The protecting cage and lamp are showing in elevation and in cross section in Figs. 3 and 4. The upper part of the ribs and the top of the ring are turned so as to present the edge of the lamp in order to secure greater strength and obscure the light as little as possible. The ribs are given a peculiar curved shape in order to allow ice and drift wood to run over the buoy without danger.

The lantern consists of a circular base and stout framework of brass having curved panes of thick glass in the sides and segmental panes in the top, with a ring at the top to serve as a handle. Three short legs attached to the bottom ring fit into holes in brass ears riveted to the ribs, and holes for ventilation are provided at the top and bottom, as shown in the illustration. The lamp is secured in place by two hinged screw clamps, fitting over brass tongues, which are also secured to the ribs. In removing the lantern it is lifted bodily out of the top of the cage, and it will be noted that this removal of the lantern brings away everything liable to need repairs and other attention.

This lamp is rated at 100 c. p., and a peculiar-shaped carbon filament was designed to secure as uniform and advantageous a distribution of the light as possible, and to reduce the obscuration of the light by the ribs of the cage and the bars of the lantern to a minimum. The circular disc at the base of the holding socket of the lamp is clamped between two discs of soft rubber by means of a sleeve which screws down on the stud or boss which projects from the centre of the removable portion of the lantern base. This removable portion is secured in place by screws and is of sufficient size to admit the lamp through the opening after the lamp is mounted. One terminal of the wire of the lamp is electrically connected to the base of the lantern, and the other is carried through the opening, having an insulating bushing and connecting with the core of the cable. One of the armored wires of the cable is soldered to a rib of the cage to insure a complete electric circuit through the core of the cable, the lamp and lantern and frame to the cable armor.

The method of carrying the cable up the buoy from the bottom is illustrated in Figs. 5 and 6. As will be seen, the cable is securely fastened by wire staples in a deep

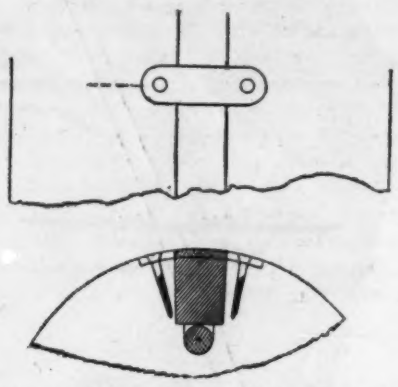


FIGS. 3 AND 4.—LAMP AND CAGE—ELEVATION AND VERTICAL SECTION.

groove cut in the buoy, and is covered by a strip of wood fitted to the groove and held in place by short iron strips let in flush with the surface and secured by screws. For a distance of several feet at the lower end of the buoy the cable is closely served with iron wire over which is wound spun yarn to prevent injury from chafing on the shackles and sinker.

From each buoy a single conductor cable is laid to the cast-iron junction box, where connection is made with one of the three cores of the treble conductor cable which leads to the shore, as shown in the map, Fig. 1. To insure the least possible resistance in that part of the circuit through the armored wire or earth, a separate copper wire of large cross section is soldered to the armored wires at the shore end, and carried to the dynamo room with the other wires on the pole line. The latter extends from the landing point of the cable a distance of 1,500 feet to the dynamo station, and carries six wires besides the single return. The station itself, which is admirably arranged, has boilers, engines and dynamos in duplicate, so as to provide against interruption of the light from accident to this part of the system. From the dynamos the wires are laid to the testing and switch-board, where the various resistances, safety plugs, indicators, testing instruments, etc., are conveniently arranged, and from there the wires pass out to the pole line before mentioned and thence into the cables.

The arrangement of the switch-board in the station is shown in Fig. 7, which is so clear as to require little explanation. The dynamos are compound wound machines



FIGS. 5 AND 6.—METHOD OF CONDUCTING CABLE UP THE BUOY.

of the Edison type and run at 152 volts. They have each two separate coils for the field magnets, one being connected as a shunt to, and the other in series with, the main circuit. The shunt field coil has an adjustable resistance in series and the series field coil has a separate external coil connected in shunt with it. The resistance of this latter can also be varied for adjustment. Each lamp on the buoys has an independent circuit in which is placed, besides the lamp, an ammeter, a safety plug and a controlling resistance for adjusting the potential of each lamp separately. And this adjustment is necessary on account of the inequalities of the line resistance, due to the unequal lengths of cable of the different lamps. There is also provided an ammeter meter for the entire current and a voltmeter. Wires are laid from each circuit wire to to a test board, where connections are provided which enable the voltage or pressure of each circuit to be measured separately when the lamps are running and also enable tests of line resistance, etc., to be conveniently made.

The cables employed aggregate 32,000 feet of 3-conductor and 15,000 feet of single conductor cable, and were made by the Bishop Gutta Percha Company, of this city. The steam plant at the station was furnished and erected by Messrs. E. P. Hampson & Co., and the land line was built by The E. S. Greeley & Co., also of this city. The Edison Manufacturing Company furnished the lamps, dynamos and the remainder of the electrical plant complete, except the adjustable resistance for the lamp circuit, which was made by the Western Electric Company.

The electrical conditions met with in working out the details of the plant were so entirely different from those usually encountered that most of the rules of practice regarding the resistance of circuits, currents and potentials to be used, etc., which are commonly adhered to, had of necessity to be widely departed from, and if the peculiar conditions imposed by a long submarine conductor and a lamp operated in a position which is practically inaccessible for considerable periods of time be taken into consideration, it will be seen that the plant is not calculated to be operated with any great degree of efficiency, so far as concerns the amount of light produced compared to the power generated.

Economy in Central Station Construction.

To the Editor of The Electrical World:

SIR: I have read the communication of "A Shareholder," in your issue of Jan. 26. His remarks with regard to "parsimony" have been sustained again and again by the general results, in electric lighting particularly. If all shareholders would take the same views as he does, and, still better, if they will imbue their directors and executive officers with the same ideas, there would be none of the deficiencies of which he complains—with what results and profit to the shareholder needs no argument. I will venture to state without fear of contradiction that an immense amount of electric light construction has proved too expensively economical. As a rule the cost of maintaining poor work (I will not call it "cheap"—only that is cheap which is good; not to mention the loss which might have been saved in leakage in first-class construction), would in the majority of instances have paid a handsome dividend on extra first cost. Then follows what is coming immediately to all such companies—cost of reconstruction in addition to the extra difficulties of extension entailed when the latter has not been anticipated, as is too often the case. With all of "Shareholder's" remarks those of us who desire honest and efficient construction will concur, and will wish that such as he "may multiply and increase and that their days may be long in the land," to the peace of mind of the true electrical engineer and to the forwarding of the proper development of electric lighting enterprises.

There is something to be said in addition to the remarks of "Shareholder," anent economy, and that is as to the status of their engineers, or superintendents. Where a company, not "parsimonious," choose an engineer they should place implicit confidence in him and allow him to be master of the situation, and not, as so frequently happens, allow their president or acting officer, after a little familiarity with electrical matters, to act as amateur consulting and constructing engineer. Such amateurs, after they have overcome their first awe of the mysterious force, usually "know all about it."

Presidents and directors of electric light companies, support your engineers and superintendents and back them up in their work if you have confidence in them. If you have not, get those in whom you have, but do not put the confidence in your own dillettante engineering. Watch the spigot and the bung-hole at the same time, and don't, in your eagerness to save at the small end, wake up to find that the leakage at the large is swamping you.

ALEX. P. WRIGHT.

BOSTON, Jan. 24, 1889.

Some Railway and Battery Questions

To the Editor of The Electrical World:

SIR: Will you please to answer the following questions: 1. Has the patent on the overhead system of wires for electric railways run out? 2. Can I make a jar out of wood for a battery by coating the wood on the inside with non-conducting cement; will it perfectly insulate it, *i. e.*, as well as a glass jar? 3. How large a jar do I need for a zinc 5 x 7 in., and two carbons 5 x 7 in., and how much sal ammoniac do I need to charge the battery?

CHICAGO, Ill. P. E. M.

ANSWER: 1. There are several patents said to cover this system, none of which have run out. 2. If well made the wooden vessel will insulate as well as glass. 3. As you do not state the thickness of the plates, no dimensions for the jar can be given. Place them in a jar in which they will fit comfortably, and add just sufficient sal ammoniac to saturate the solution.—EDS. E. W.

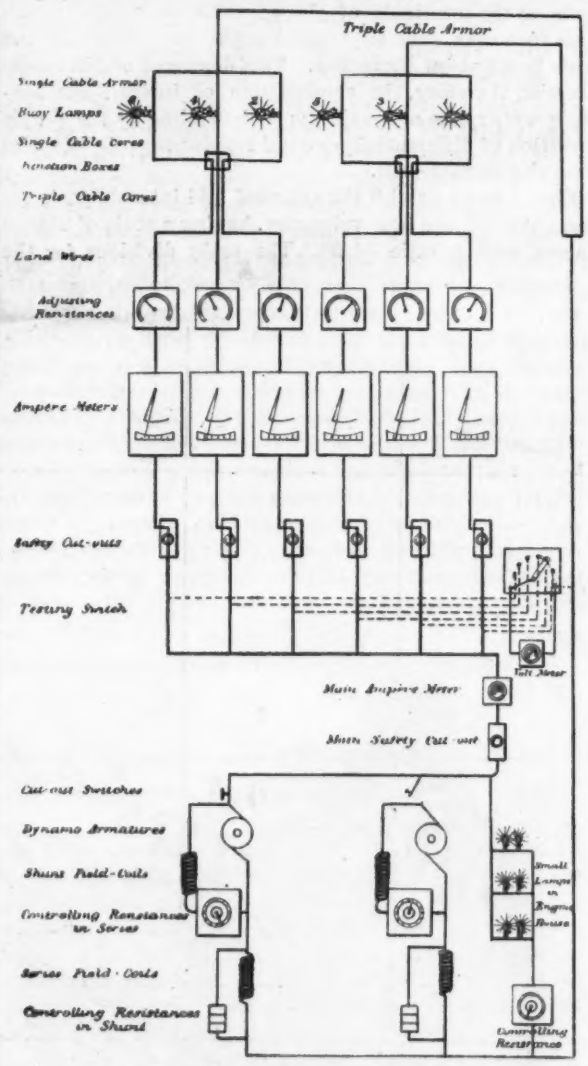


FIG. 7.—SWITCH-BOARD AT DYNAMO STATION AND CIRCUITS.

Indicating Electric Heart Action.

To the Editor of The Electrical World:

SIR: I see in one of the back numbers of THE ELECTRICAL WORLD an article on the E. M. F. of the heart. Please explain how the instrument is made to show how the heart beat. R. H. M.

WASHINGTON, D. C.

ANSWER: There was no special instrument constructed for this purpose. A galvanometer or rather mercury electroscope was employed as described in the article, with which the electromotive force of the current generated by the heart action was ascertained at successive instants of time during each heart-beat. From these the curve shown was constructed; the ordinates denoting the E. M. F., and the abscissæ the time intervals.—EDS. E. W.

The Sturtevant Engines for Electric Lighting.

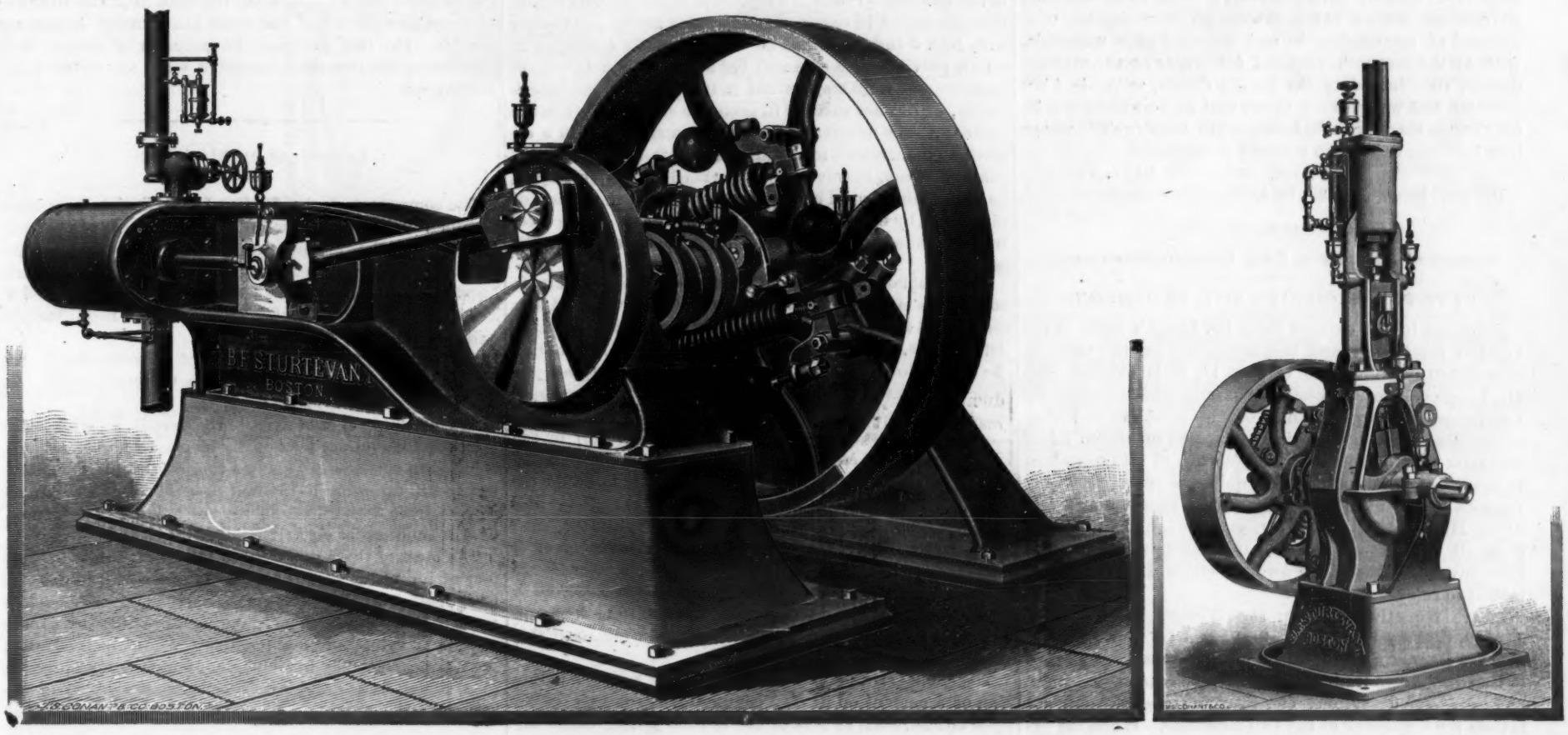
Our illustration, Fig. 1, represents one type of automatic engine built by Mr. B. F. Sturtevant, of Boston, and designed specially for driving dynamos at constant speed independent of the variation in load. The engine has a main and a cut-off valve driven by independent eccentrics, and a separate outboard pedestal. The most marked characteristic, however, is the novel and peculiar form and combination of the main and cut-off valves.

The passages in the main valve, for the admission of steam to the cylinder, do not extend through the entire thickness of the valve, as is usually the case when a riding valve is used, but resemble the exhaust cups, except that they are only as wide as the ports in the cylinder. Within the thickness of the main valve is a cylindrical seat in which runs a cut-off piston valve, which receives from the variable cut-off eccentric a differential movement relatively to that of the main valve, such that it is withdrawn just before the beginning of the stroke, opening the passage through the main valve into the cylinder. The piston valve returns, at the dictation of the governor, to close the passage and cut off the steam. As at this time the two valves are moving in opposite directions, this action is almost instantaneous; visible evidence of which is given in the indicator cards taken from these engines. The main valve is carefully balanced by pressure plates upon its back so that the power required to move it is reduced to a minimum.

The governor of this engine is of novel construction. Supported by four studs upon the arms of the governor pulley are four weights, co-operating by their centrifugal force to compress two long and powerful springs. The cut-off eccentric is pivoted to the hub of the governor and is so connected with this system of weights and springs that the action of the weights swings it across the shaft, regulating the cut-off, but in no way affecting the admission, exhaust and compression, which are controlled by the main valve. The heavy weights, the stiff springs and the balanced frictionless valve combine to make the governor excessively sensitive to the least change in the load and speed, but too sudden action on its part is prevented by a dash-pot connected with the system of weights and springs.

The engine is also provided with complete lubricating arrangements, all the oil cups being of the sight feed pattern and the wrist and crank pins being provided with wipers.

For smaller power, such as required for driving dynamos in isolated plants, the single upright automatic engine shown in Fig. 2 is built by the same firm. In this engine the admission of steam is regulated by changes in the travel of the valve, effected by the movement of the eccentric across the shaft. The point of cut-off is thus variable, according to the load, from zero to seven-eighths of the stroke, and an exceeding economical distribution of the steam is secured. The governor wheel, owing to its weight, serves as a balance wheel, and may be utilized as a band wheel. The opposite end of the shaft is splined to receive an additional wheel, if desired. The direction of rotation of the engine may be easily changed by transferring to the empty holes in the arms of the governor the studs which carry the weights and levers, and at the same time reversing the position of the weights, levers and springs.



FIGS. 1 AND 2.—STURTEVANT ENGINES FOR ELECTRIC LIGHTING.

Caustic Potash and Bromine Elements.

According to Herr Koosen (Wiedemann's *Annalen*, Vol. XXXII., pp. 508–515), when caustic potash is employed in a Daniell cell instead of acid, its action is as follows: 1. KHO is decomposed, giving K, O and water. 2. K replaces zinc, forming sulphate of potash instead of sulphate of zinc. 3. Zn is oxidized by the liberated oxygen. 4. The zinc oxide thus formed is dissolved into the undecomposed KHO solution. Of these four reactions (1) diminishes the E.M.F., (2) and (3) strengthen it, as possibly does (4). The E.M.F. obtained in practice agrees well with theory. A Daniell cell made up with tolerably strong caustic potash remains very constant on a high external resistance. Caustic soda answers still better, as it dissolves the zinc oxide more freely. It is important to avoid diffusion as much as possible, and for this purpose Herr Koosen prefers to employ two porous pots, one inside the other, with the space between filled with a solution of sulphate of soda or potash respectively. He also mentions a zinco-bromide-platinum cell without porous pot, which he has found to remain constant on closed circuit for months together; the bromine is covered with a layer of paraffin oil.

An Hour in an Atlantic Cable Station.

On the evening of Jan. 28, Mr. Charles Cuttriss, electrician of the Commercial Cable Company, delivered a most interesting address before the New York Electrical Society, entitled as above, in which he gave the details and the routine of the every-day work of a cable station. Mr. Cuttriss began his address by pointing out the difference between ocean and land lines, and drew attention to the fact that the first method employed in cable working was the Morse system, with which, however, it was soon ascertained only three or four words per minute could be transmitted. Cable telegraphy was, in fact, seriously jeopardized until Sir. Wm. Thomson devised his application of the mirror galvanometer for that service. Mr. Cuttriss described the construction of the mirror galvanometer, and the method of its employment, and remarked that it was still frequently used as a receiving instrument. The great drawback to its use was the fact that it left no record of the message sent, and hence it became necessary to invent a recording instrument; this was also designed by Sir Wm. Thomson. The lecturer described and illustrated the recorder as constructed at the present time, and drew attention to some of the troubles encountered in its use.

Principal among these was the difficulty met with in the electrification of the ink on damp days, which is so seriously affected by static electricity at such times as to leave the recorder useless. In order to overcome this defect various methods had been proposed, among them being the vibration of the siphon by means of electro-magnetic attraction, and Mr. Cuttriss described the instrument, designed by himself for this purpose, which has now been in successful operation for several years.

The lecturer then described the method of duplex cable working, and illustrated the Stearns and the Muirhead systems, the latter of which is now employed on most cables. In this connection Mr. Cuttriss described the Muirhead condenser, which solved the difficulty formerly encountered, by combining both a resistance and a condenser in one apparatus by constructing the condenser of continuous strips instead of large sheets.

In order to show the delicacy and accuracy required in cable work, Mr. Cuttriss instanced the fact that the recorder is sensitive to one volt through 100,000 ohms, or to $\frac{1}{100}$ of a milliampère.

Frequently the characters, as they appear on the recorder, are caused by current strengths varying in intensity down to $\frac{1}{2000}$ of a milliampère. He also stated that the varying temperature of the Gulf Stream at different times of the year has to be compensated for in the artificial line of the duplex arrangement, and that not infrequently the cable passing over the Brooklyn Bridge is affected by the difference in temperature caused by the passage of a cloud on a sunny day.

At the close of Mr. Cuttriss' address, Mr. Frank W. Jones, electrician of thePostal Telegraph Company, gave a brief description of the dynamo plant designed by him and employed on the system of that company in this city.

Hemp Sheathed Deep Sea Cables.

To the Editor of The Electrical World:

SIR: In your issue of the 26th you quote, in extenso, an article from the pen of Judge R. L. Weatherbee, taken from the *Halifax Chronicle* of the 12th of the present month, headed "Problems and Conditions of Ocean Telegraphy." You also in same issue give a short editorial on "Unarmored Ocean Cables."

It is true that Halifax is and always has been the rendezvous of the Atlantic cable repairing ships, and more especially is this the case with the Anglo-American Telegraph Company's S.S. "Minia," which I command, and of which Mr. Hamilton is chief electrician. Therefore, with an able lawyer and an expert in "weighing testimony," as is the case with Judge Weatherbee, it would not be difficult for him, while studying this important subject, to get many details which even those who have been considered experts in submarine telegraphy are deficient of; and while I do not deny that the eminent judge may have, from time to time, elicited from myself and others with whom I am associated, some of the information he was seeking—and also admitting that the conclusions he has arrived at are pretty correct—yet it is only just to myself and others to say that we had no knowledge of his intention to write on cable matters, neither do we yet know to what *profound depths* his researches in submarine telegraphy have taken him.

In your article on "Unarmored Cables," you state that "It would indeed be a great change if our ocean cables hereafter were of the type he describes, with a greatly increased capacity for speed in working." Although for obvious reasons we have not written on this subject—but have quietly worked on, knowing the inevitable must come, when the merits of the type of cable we advocate are fully known—it is now some four years since we entertained high hopes that with our patent deep-sea type of cable we should not only get greater durability, but that we should also get a considerable increase of speed. *The work we have already accomplished fully confirms the anticipations we then entertained, and gives us greater hope for the future.*

For the benefit of your readers I will quote what Professor Geo. Forbes said on the evening of January 28, 1886, in the discussion on a paper read before the Society of

Telegraph Engineers and Electricians by Professor D. E. Hughes on "The Self-Induction of an Electric Current in Relation to the Nature and Form of its Conductor." The quotation is from the Society's journal, vol. XV., page 44, and reads as follows: "There is a third practical point which is not so much illustrated in the experiments described in Professor Hughes' paper as with some further experiments which he was kind enough to undertake in connection with some theoretical notions that I ventured to throw out with regard to the influence of an iron sheath round a conductor. In such a case the self-induction bebecomes enormously increased, as we could easily see from theoretical grounds, and I trust that this investigation may lead to some practical modification of the construction of telegraph cables. For many years I have tried to impress upon those who have had a great deal to do with the construction of telegraph cables in the past what an important point this seemed to me; but the importance of it is proved more evidently by the experiments of Professor Hughes; that is to say, that by surrounding the cable with a sheath of iron instead of surrounding it with a sheath of gun metal, or some other non-oxidizable and non-magnetic material which is sufficiently strong, we are introducing an enormous amount of self-induction, * * * and I believe that I am not wrong in saying that the self-induction produced in one of our Atlantic cables is probably greater than the self-induction which could be produced by any of the most powerful magnets which have ever been constructed."

It is just possible that Professor Geo. Forbes may not have heard of Trott & Hamilton's patent deep-sea cable; but should this meet his eye, as it doubtless will, I can assure him that we have just such a cable as he was then advocating, viz., a cable having no iron sheath, constructed of non-oxodizable and non-magnetic materials, with all the strength required for water of the greatest depths, *even including the Pacific Ocean, with its* 4,500 *fathoms*, and we venture to say that its durability will be far greater than any other cables yet constructed, where iron has been used as an element of strength.

SAML. TROTT.

BOSTON, Mass., Jan. 28, 1889.

Abnormal Magnetism from Electric Discharges.

BY PROF. H. S. CARHART, UNIV. OF MICHIGAN.

Referring to the extract from Dr. Lodge's letter in the London *Electrician*, and the comments on the same in THE ELECTRICAL WORLD of Jan. 12, it is evident that Dr. Lodge has drawn conclusions rather hastily from his Leyden jar discharges. There can be no doubt whatever of the "abnormal magnetism" in which he has no faith. The reference to Professor Henry's work in 1842 contained in the WORLD'S editorial note is quite the appropriate one. Henry explained the matter with great insight and acuteness. His explanation of abnormal magnetism will appear all the more reasonable if viewed in the light of some investigations of my own, to which I may be permitted to refer.

I have recently shown in the *Western Electrician* of Jan. 12, that steel rods 6 cm. long, and 1.8 mm. in diameter are magnetized ordinarily by a discharge, or by repeated discharges from a quart jar, in concentric layers, and in reverse directions. The resulting magnetic moment is then the difference of the two moments. When the external shell of reversely magnetized steel is removed by acid, the total magnetic moment increases. The reverse magnetism usually extended to a depth of about one-third the entire magnetized shell. The core of these rods in all cases remained unmagnetized.

If now very small needles were used so that the first discharge would be more than enough to magnetize to saturation, then it is easily seen that the reverse discharge in the oscillatory movement (perhaps the first reverse one) might reverse somewhat more than half the magnetism produced by the first direct discharge, leaving a resultant reverse magnetization. It is by no means necessary to reverse all of it to show abnormal magnetism externally, as Professor Henry supposed, so that the conditions for obtaining "abnormal magnetism" are more easily reached even than he imagined.

If Dr. Lodge will remove the external portions of his little magnets with acid and measure the magnetic moments as they diminish in diameter slowly he will readily convince himself of the existence of reversely magnetized shells; and if he will use small enough needles or sufficiently large discharges he will probably conclude not to give up his faith in the teachings of the fathers so readily.

[We give below the experiments of Professor Henry on this subject as they appear in the "Scientific Writings of Joseph Henry," published by the Smithsonian Institution.—EDS. E. W.]

*On Induction from Ordinary Electricity and on the Oscillatory Discharge.**

Professor Henry presented the record of a series of experiments on induction from ordinary electricity as the fifth number of his "Contributions to Electricity and Magnetism." Of these experiments he gave an oral account, of which the following is the substance:

*Proceedings of the American Philosophical Society, Vol. II., pp. 193-196, June 17, 1842.

In the third number of his contributions he had shown on this subject: 1. That the discharge of a Leyden battery through a conductor, developed in an adjoining parallel conductor an induced current, analogous to that which, under similar circumstances, is produced by a galvanic current. 2. That the direction of the induced current, as indicated by the polarity given to a steel needle, changes its sign with a change of distance of the two conductors, and also with a change in the quantity of the discharge of electricity. 3. That when the induced current is made to act on a third conductor, a second induced current is developed, which can again develop another, and so on through a series of successive inductions. 4. That when a plate of metal is interposed between any two of the consecutive conductors, the induced current is neutralized by the adverse action of a current in the plate.

The direction of the induced currents in all the author's experiments was indicated by the polarity given to steel needles inclosed in a spiral, the wire of which formed a part of the circuit. But some doubts were reasonably entertained of the true indications of the direction of a current by this means, since M. Savary had announced in 1826, that when several needles are placed at different distances above a wire through which the discharge of a Leyden battery is passed, they are magnetized in different directions, and that by constantly increasing the discharge through a spiral, several reversions of the polarity of the contained needles are obtained.

It was therefore very important before attempting further advances in the discovery of the laws of the phenomena that the results obtained by M. Savary should be carefully studied, and accordingly the first experiments of the new series relate to a repetition of them. The author first attempted to obtain them by using needles of a larger size, Nos. 3 and 4, such as he had generally employed in all his previous experiments; but although nearly a thousand needles were magnetized in the course of the experiments, he did not succeed in getting a single change in the polarity. The needles were always magnetized in a direction conformable to the direction of the electrical discharge. When, however, very fine needles were employed, he did obtain several changes in the polarity in the case of the spiral, by merely increasing the quantity of the electricity, while the direction of the discharge remained the same.

This anomaly, which has remained so long unexplained, and which at first sight appears at variance with all our theoretical ideas of the connection of electricity and magnetism, was, after careful study, satisfactorily referred by the author to an action of the discharge of the Leyden jar, which had never before been recognized. The discharge, whatever may be its nature, is not correctly represented (employing for simplicity the theory of Franklin) by the single transfer of an imponderable fluid from one side of the jar to the other; the phenomona require to admit *the existence of a principal discharge in one direction, and then several reflex actions backward and forward, each more feeble than the preceding, until the equilibrium is obtained.* All the facts are shown to be in accordance with this hypothesis, and a ready explanation is afforded by it of a number of phenomena which are to be found in the older works on electricity, but which have until this time remained unexplained.

The same action is evidently connected with the induction of a current on its own conductor, in the case of an open circuit, such as that of the Leyden jar, in which the two ends of the conductor are separated by the thickness of the glass. And hence, if an induced current could be produced in this case, one should also be obtained in that of a second conductor, the ends of which are separated, and this was detected by attaching to the ends of the open circuit a quantity of insulated metal, or by connecting one end with the earth.

The next part of the research relates to a new examination of the phenomena of the change in the direction of the induced currents, with a change of distance, etc. These are shown to be due to the fact that the discharge from a jar does not produce a single induced current in one direction, but several successive currents in opposite directions. The effect on the needle is principally produced by two of these; the first is the more powerful, and in the adverse direction with that of the jar; the second is less powerful, and in the same direction with that of the jar.

To explain the change of polarity, let us suppose the capacity of the needle to receive magnetism to be represented by ± 10, while the power of the first induced current to produce magnetism is represented by — 15, and that of the second by + 12; then the needle will be magnetized to saturation or to — 10 by the first induced current, and immediately afterward all this magnetism will be neutralized by the adverse second induction, and a power of + 2 will remain, so that the polarity of the needle in this case will indicate an induced current in the same direction as that of the jar.

Next, let the conductors be so far separated, or the charge so much diminished, that the power of the first current to develop magnetism may be reduced to — 8, while that of the second current is reduced + 6, the magnetic capacity of the needle remaining the same. It is evident, then, that the first current will magnetize the needle to — 8, and that the second current will immediately afterwards neutralize 6 of this, and consequently the needle will retain a magnetism of — 2, or will indicate an induced current in an opposite direction to that of the jar.

In extending the researches relative to this part of the investigations, a remarkable result was obtained in regard to the distance at which inductive effects are produced by a very small quantity of electricity; a single spark from the prime conductor of the machine, of about an inch long, thrown on the end of a circuit of wire in an upper room, produced an induction sufficiently powerful to magnetize needles in a parallel circuit of wire placed in the cellar beneath, at a perpendicular distance of thirty feet, with two floors and ceilings, each fourteen inches thick, intervening. The author is disposed to adopt the hypothesis of an electrical *plenum*, and from the foregoing experiment it would appear that the transfer of a single spark is sufficient to disturb perceptibly the electricity of space throughout at least a cube of 400,000 feet of capacity; and when it is considered that the magnetism of the needle is the result of the difference of two actions, it may be further inferred that the diffusion of motion in this case is almost comparable with that of a spark from a flint and steel in the case of light.

The author next alludes to a proposition which he advanced in the second number of the "Contributions," namely, that the phenomena of dynamic induction may be referred to the known electrical laws, as given by the common theories of electricity, and he gives a number of experiments to illustrate the connection between statical and dynamical induction.

The last part of the series of experiments relates to induced currents from atmospheric electricity. By a very simple arrangement needles are strongly magnetized in the author's study, even when the flash is at the distance of seven or eight miles, and when the thunder is scarcely audible. On this principle he proposes a simple self-registering electrometer connected with an elevated exploring rod.

Executions by Electricity.

The committee of the Medico-Legal Society appointed to consider the best method of executing the death penalty by electricity has made a supplementary report giving the results of the recent experiments made with the electric current upon animals. The committee was composed of Frederick Peterson, R. Ogden Doremus, F. H. Ingram and J. Mount Bleyer.

A tabular appendix of the result of experiments in the Edison laboratory and at Columbia College is given. In conclusion the report says:

"If any doubt should exist in the minds of some that electricity would not necessarily be fatal to man because it has been successfully applied to lower animals, we have but to call attention to the fact that since 1883 some 200 persons have been killed, as we are creditably informed, by the handling of electric lighting wires.

"As most of these people were killed probably by contact of the hands with the wires, it shows that in man at least death is rapid in this manner. Hence the suggestions made to this committee as to the use of wristlet electrodes have their value; and it is possible that this method, with the prisoner fastened in a chair, may ultimately prove the most desirable, as doing away with a complication of appliances and lending greater simplicity to the procedure."

The Effect on Electric Lighting of the Bate Decision.

The opinion of the Supreme Court in the case of the Bate Refrigerating Company versus George H. Hammond & Company, which was handed down last Monday, Jan. 21, is stated by Messrs. Dyer and Seely to affect favorably, as regards prosecution of infringement, the following Edison electric light patents, upon which suits have been pending for some time against competing electric light companies, and the prosecution of which suits has been delayed up to the present time by the technical obstacle which the decision of the Supreme Court removes. Those patents are:

No. 223,898, covering the broad invention of the filament lamp.

No. 227,229, covering the use of high resistance enclosed conductor in a vacuum chamber entirely of glass.

No. 265,777, covering the perfection of the carbon filament in the driving out of the occluded gases in the vacuum by the heat of the current.

No. 265,311, covering broadly the employment of a lamp removable from the socket.

No. 251,554, on positive connection between the lamp and the socket, so that the position of the lamp can be reversed.

No. 230,255, on making the closed chamber of the lamp in two parts, fused together.

No. 266,447, on making the closed chamber of the lamp in two parts, fused together when the globe is made from pot blown glass.

No. 248,419 and No. 264,698, on details of glass construction.

No. 248,424, on providing a pendent incandescent lamp, removable from its socket, with a shade or reflector placed

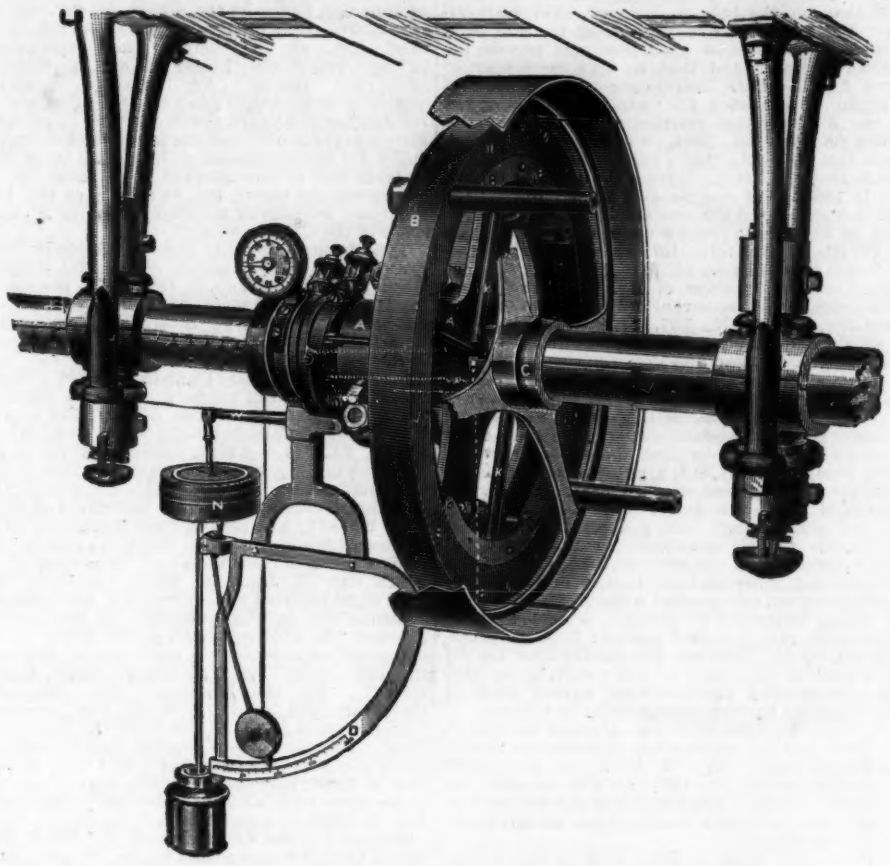
above it, so that the lamp can be moved and placed without disturbing the shade.

No. 263,140, covering the use of two or more commutator brushes.

No. 251,540, on making the filament of bamboo or other fibrous material, having the fibres running parallel throughout the length of the filament.

Suits on these patents are pending in the circuit court of the Southern District of New York against the United States Electric Lighting Company, the United States Illuminating Company, two customers of the latter company, the Consolidated Electric Light Company, and two customers of that company, and the Swan Incandescent Electric Light Company, and two customers of that company (with the exception of the last patent, on which the suits were brought only against the Consolidated Company and customers and the Swan Company and customers).

In addition to the above patents, the Edison feeder patent, No. 264,642, on which suit was brought versus Westinghouse, Church, Kerr & Co., at Trenton, N. J., is also held to be affected favorably by the decision of the Supreme Court.



THE EMERSON POWER SCALE FOR ELECTRIC STATIONS.

The Emerson Power Scale for Electric Stations.

Nearly all the knowledge we have of the amount of power absorbed by the dynamos in electric lighting stations has been obtained by taking indicator cards from the engines under the several conditions of the load. This method is at best only approximate, and often inaccurate, especially with variable loads, a fact which has long been evident to those who have had much experience with the indicator for power measurement. In these days of close competition, when even the minutest details are considered in the cost of production, the manager of the station should know definitely, and certainly more directly, the amount of power being delivered to the dynamos at any and all times. To meet the demand for greater accuracy in this respect, there has recently been applied for this purpose a simple and convenient apparatus, which will particularly claim the attention of all engaged in electric distribution of whatever kind. We refer to the Emerson power scale, which is illustrated in the engraving.

The scale as here shown is the result of long experiment, and in its present state power can be measured by any person of ordinary intelligence as easily as a load is weighed on a common scale.

Fig. 1 represents what is termed the shaft scale, of which there are five sizes, varying in capacity from four to one hundred and eighty horse-power at one hundred revolutions of the shaft, the capacity of course varying proportionally with the speed. It is applicable to any size of shaft and pulley, and is made in halves like a split pulley, so that it is not necessary to take down any shafting to apply it.

The principle of its working is as follows: The pressure which is exerted on the studs of the outer rim *B* is transmitted by a system of levers and connecting links to the sliding collar and forked lever, where it is balanced and measured by means of weights on the pan *N* and by the raising of the pendulum weight *P* along the graduated quadrant *D*. It is thus the same in principle as the Fairbanks platform scale applied to transmitted force, where the point of application of the force describes a certain number of feet in rotation.

In applying the Emerson power scale, the pulley which is receiving or delivering the power to be measured is first made loose on the shaft. The scale is then placed in position close to the hub of the pulley, and secured firmly to the shaft. The studs in the rim *B* project between the arms of the pulley, and should bear equally upon them. A speed counter is attached to the hub of the scale, and shows the number of revolutions of the shaft on which it is placed. The dashpot *S* is filled with thin oil, and prevents unnecessary oscillations of the pendulum weight, occasioned by sudden changes in the load.

To compute the horse-power by this appliance, let us suppose we were using a No. 3 scale, the constant of which is 6 (feet); revolutions of shaft, 450; net weight, 375 lbs. Then

$$\frac{450 \times 375 \times 6}{33{,}000} = 30.68 \text{ h. p.}$$

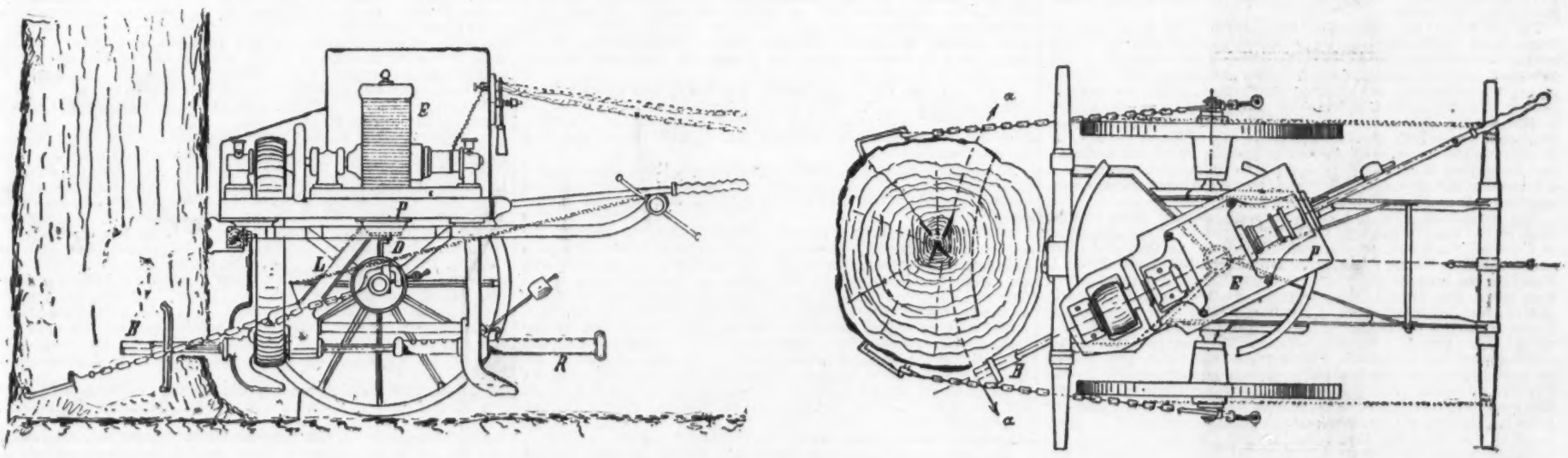
Besides the shaft scale there are other forms of the power scale, such as the coupling scale, which is designed to replace an ordinary shaft coupling, and determines the amount of power used by any length of shafting, and other forms for special applications are also made. For electric lighting stations, in cases where the engine is belted directly to the dynamos, there is a special form of the power scale provided, which is made in the form of a pulley and takes the place of the pulley on the dynamo shaft.

Another important application of the power scale is to be found in the many installations of electric motors, which are rapidly replacing steam and all other motors for small users of power. In nearly all cases there is no means of ascertaining the amount of power necessary, or the amount furnished, except by electrical measurements and these to the ordinary consumer are quite unintelligible. By the use of this appliance, however, the consumer may know at a glance the exact amount of power he is using at any time. In this way he may note the variation of his work from day to day, and determine the causes thereof, and in general can be constantly informed as to the cost of his power, and thereby make the most economical use of it.

This instrument has been used for a number of years for weighing power in cotton mills and other manufacturing industries, and many remarkable results in the saving of power have been obtained by its use. But it has only recently been applied to the electrical industries, and it will no doubt reveal in this field as many and important chances of improvement in the economical use of power.

Electric Tree Felling Machine.

Hitherto the only mechanical appliance to supersede hand labor in the felling of trees has been the steam tree feller, but the employment of steam for such a purpose is coupled with considerable difficulties. Not only is it necessary to place the boiler in close proximity to the tree to be felled, but the weight of the machine itself is considerable, and its application when the ground is uneven is somewhat troublesome. In a dense forest machinery of this description can only be used when the tree to be felled is either on the borders of the forest or is in a clearance accessible by a road over which the boiler can be transported. These difficulties are greatly minimized, if not entirely overcome, by the application of electricity.



FIGS. 1 AND 2.—AN ELECTRIC TREE FELLING MACHINE.

The source of power in this case is not a boiler, which must be placed near to the tree, but some prime mover and dynamo machine, which may be erected at any reasonable distance from the scene of operations all that is required to convey the power being a pair of insulated cables, which can be easily brought into the innermost parts of the forest. The felling machine itself is lighter and smaller than a corresponding steam saw, and can therefore be taken over difficult ground and through narrow places where the former could not pass. We illustrate from *Industries*, in plan and elevation, an electric tree felling machine which has been brought out by Messrs. Ganz & Co., of Budapest, especially for use in the Galician forests. The separation of the tree from the stump is in this case not effected by a saw, as is usual but by a special drill. According to the nature of the wood, this drill may be used either to

perforate the base of the tree with a series of holes, placed so close together that when the operation is completed all the fibres have been cut through; or it may be used to take a sweeping cut, in which case the tool is shaped somewhat in the fashion of a twist drill, but with prominent cutting edges along its side. The latter method is adopted for medium hard and for soft woods, and is illustrated in our diagram. The electric motor *E*, with its platform *P*, is placed on a light two-wheel carriage, which is taken close up to the tree, and shackled to it by clamps and chains, the latter being attached to the axles of the carriage in such a way as to be readily detachable, so that the carriage may be quickly withdrawn if there should be danger of the tree falling before the operation is completed. The platform of the motor is mounted upon a vertical spindle *D*, in such a way that it can swivel in a horizontal plane. The drill *B* is carried in a spindle, which receives motion from the motor by means of belt gear, the spindle being provided with a long key bed, and the pulley with a fast feather, so that the spindle may be shifted forwards or backwards by means of the rack *R*

The mode of operation is as follows: After the machine has been brought up to the tree and shackled to it, the current is switched on, and a sweeping cut of suitable depth is taken across the surface of the tree by slowly rotating the motor on its vertical spindle. The drill is then advanced by a few inches, and a second cut is taken in the same manner, until about half the thickness of the tree has been separated from the stump. When this point is reached clamps are driven in to keep the cut from closing up by the weight of the tree, and the operation is continued until a point is reached when it would not be safe to cut away more of the wood. The shackling chains are then loosened and the carriage is withdrawn to a safe distance, after which the final separation of the tree from the stump is performed by a hand saw or by the axe.

The Bate Refrigerating Company Decision by the U. S. Supreme Court.

Supreme Court of the United States: The Bate Refrigerating Company, appellant, vs. George H. Hammond & Co. Appeal from the Circuit Court of the United Statrs for the District of Massachusetts.

[January 21, 1889.]

Wm. M. Evarts, John Lowell, C. A. Seward, Richard N. Dyer and Paul H. Bate, for appellant.

Benjamin F. Thurston and George H. Lothrop for appellee.

Noah Davis for Edison Electric Light Company.

Edmund Wetmore, Samuel A. Duncan and Leonard E. Curtis for U. S. Electric Lighting Company.

Wm. Bakewell and Thomas B. Kerr for Westinghouse Electric Company.

Amos Broadnax for Consolidated Electric Light Company.

Chauncey Smith, Thomas L. Livermore and Frederick P. Fish for Thomson-Houston Electric Company.

R S. Taylor for Fort Wayne Electric Light Company.

John R. Bennett for B. W. Gillett and others for Joseph Eastman.

R. Mason for himself.

Mr. Justice Blatchford delivered the opinion of the Court.

This is a suit in equity, brought in the Circuit Court of the United States for the District of Massachusetts, Dec. 16, 1886, by the Bate Refrigerating Company, a New York corporation, against George H. Hammond & Co., a Michigan corporation, founded on the alleged infringement of Letters Patent No. 197,314, granted to John J. Bate, Nov. 20, 1877, for the term of seventeen years from that day, on an application filed Dec. 1, 1876, for an "improvement in processes for preserving meats during transportation and storage."

The plaintiff is the assignee of the patent. The bill alleges infringement, within the District of Massachusetts and elsewhere in the United States, by the making, using and vending of the patented process, and alleges that the defendant has been engaged in the business of shipping fresh meat from the port of Boston to ports in Great Britain, by means of the process claimed in the patent. The claim is as follows: "The herein described process of preserving meat during transportation and storage, by enveloping the same in a covering of fibrous or woven material, and subjecting it when thus enveloped to the continuous action of a current of air of suitably low and regulated temperature, substantially as and for the purpose set forth."

The defendant filed a plea, setting up, among other things, that, on the 9th of January, 1877, letters patent of the Dominion of Canada, No. 6,938, for the same invention as that described and claimed in No. 197,314, were granted to the same John J. Bate, for the term of five years from the 9th of January, 1877; that after No. 197,314 had expired, at the end of the term of five years for which such Canadian patent was granted, the Circuit Court of the United States for the District of New Jersey, upon being advised of the grant of such Canadian patent, vacated and set aside an injunction which it had theretofore granted, by an interlocutory decree made in a suit in equity founded on No. 197,314, brought by the Bate Refrigerating Company against Benjamin W. Gillett and others; that thereafter Bate and the Bate Refrigerating Company procured the rendition of a judgment by the Superior Court for Lower Canada, declaring the Canadian patent to have been void *ab initio*, and vacating it and setting it aside; that such judgment of the Superior Court for Lower Canada being brought to the attention of the Circuit Court of the United States for the District of New Jersey, that court reinstated said injunction; and that afterward the Superior Court for Lower Canada, in a suit brought by Sir Alexander Campbell, Minister of Justice and Attorney General for the Dominion of Canada, against Bate and the Bate Refrigerating Company and others, adjudged that its said prior judgment had been "arrived at through the fraud to the law and collusion" of Bate, the Bate Refrigerating Company and another person, "deceiving the Attorney-General, the advocates and the Court, employing and paying counsel on both sides, as well, seemingly, against themselves as on their apparent behalf," and revoked and annulled its said prior judgment. The plea concluded by averring that No. 197,314 expired on the 9th of January, 1882, and that the Circuit Court, sitting as a Court of Equity, had no jurisdiction to hear and determine an action in equity for the infringement of the patent.

The bill was then amended by averring that the application for the Canadian patent was not made until Dec. 19, 1876, while the application for No. 197,314 was made Dec 1, 1876 and that the Canadian patent was not actually or legally issued until on or about June 26 1878, on or about which date a model of the invention, as required by law, was filed in the Canadian Patent Office. The amendment to the bill also set forth the two judgments of the Superior Court for Lower Canada, and averred that, by virtue of an act of the Parliament of the Dominion of Canada, assented to May 25, 1883 (46 *Victoria, Chap.* 19), the original term of the Canadian patent was actually fifteen years, instead of five years, and it would not terminate before Jan. 9, 1892.

Subsequently the defendant filed an answer to the bill, setting up, among other defenses, want of novelty in the patented invention, but not denying that it had used the invention subsequently to the granting of the patent, and also setting up the granting of the Canadian patent for five years from Jan. 9, 1877; that No. 197,314 was void, because it was issued for seventeen years, and its term was not limited by the Commissioner of Patents to five years from Jan. 9, 1877; that the Canadian application was not made until after the application for No. 197,314 was filed; that Bate did not file a model in the Canadian Patent Office until after the grant of the Canadian patent, and that the Canadian patent was actually patented to Bate on the 9th of January, 1877, and took effect on that date, although not actually delivered to the patentee until after the filing of the model. It also sets forth the two Canadian judgments, and avers that on the 30th of November, 1881, Bate made a petition to the Commissioners of Patents for Canada for the extension of No. 6,938, in which he averred that on the 9th of January, 1877, he "obtained a patent for the period of five years from the said date for new and useful improvements on apparatus and process for ventilation, refrigeration, etc.," and that he was the holder of that patent in trust for the Bate Refrigerating Company, and prayed that it might be extended for "another period of ten years;" that on the filing of that petition an extension of the patent was granted on Dec. 12, 1881, "for a second period of five years" from Jan. 9, 1882; that a further extension of the patent was granted Dec. 13, 1881, "for a third period of five years," from Jan. 9, 1887; that the plaintiff is thereby estopped from denying the fact that No. 6,938 was legally granted Jan. 9, 1877, for a period of five years; that by virtue of the Act of 46 *Victoria, Chap.* 19, the original term for which No. 6 938 was granted was not fifteen years instead of five years; that said act can have no effect on the duration of No. 197,314; that by reason of the prior patenting of the invention by Bate in Canada for five years from Jan. 9, 1877, No. 197,314, if valid at all, expired on Jan. 9, 1882; and that, therefore, this Court, sitting in equity, has no jurisdiction to hear and determine an action for its infringement.

Without the filing of any replication to this answer the parties entered into a written stipulation, setting forth as follows: "Whereas, the answer of the defendant corporation in this cause sets up, in addition to other defenses, that the patent on which this suit is brought, being No. 197,314, granted to John J. Bate, complainant's assignor and president, on the 20th day of November, A. D. 1877, expired on the 9th day of January, A. D. 1882, by reason of the prior grant to said John J. Bate of a patent in the Dominion of Canada for the same invention, and prays the same benefit of said defense as if the same had been pleaded to the bill of complaint; and, whereas, both parties desire to have said matter of defense argued and decided without incurring the great expense of taking testimony necessary to present for final hearing all the defenses raised in said answer: It is, therefore, stipulated and agreed by and between the parties that the defense above named shall be submitted to the Court, as on plea set down for argument, upon the following agreed state of facts." The facts so agreed to were substantially as follows:

1. The patent in suit, No. 197,314, was granted to John J. Bate on Nov. 20, 1887, and the application therefor was filed in the United States Patent Office, Dec. 1, 1876; and said patent was assigned to complainant before this suit was brought, the said Bate being a citizen of the United States at the time of said application, and the said invention having been made and reduced to practice by him therein.

2. On Dec 19, 1876, said John J. Bate filed in the Patent Office of the Dominion of Canada an application for a patent for improvements in apparatus and processes for ventilation, refrigeration, etc., including therein as one feature the process described and claimed in said patent No. 197,314.

3. In pursuance of said application the Commissioner of Patents for the Dominion of Canada caused letters patent of the Dominion of Canada, No. 6,938, for the invention set forth in said application, and granted to said John J. Bate, his executors, administrators and assigns, the exclusive right, privilege and liberty of making, constructing, using and vending to others to be used, the said invention, to be signed and sealed with the seal of the Patent Office on Jan. 9, 1877, and to be registered on Jan. 11, 1877, and that the period of said grant expressed in said patent was five years from and after Jan. 9, 1877.

4. On Jan. 12, 1877, said Commissioner of Patents called upon said John J. Bate to furnish to the Patent Office a model of his said invention, and such model was furnished by said Bate on June 26, 1878, on which day said patent No. 6,938 was mailed to said John J. Bate.

5. On Dec. 5, 1881, said John J. Bate filed a petition in the Canada Patent Office, setting forth "that on the 9th day of January, A. D. 1877, your petitioner obtained a patent for the period of five years from the said date for new and useful improvements on apparatus and process for ventilation, refrigeration, etc.; that he is the holder of the said patent in trust for the 'Bate Refrigerating Company,' and therefore prays that it may be extended for another period of ten years."

6. On Dec. 12, 1881, said patent No. 6,938 was extended for five years from Jan. 9, 1882, under renewal No. 13,812, and on Dec. 13, 1881, said patent was further extended for five years from Jan. 9, 1877, under renewal No. 13,813, in pursuance of the above-named petition.

7. On or about July 9, 1883, and June 30, 1886, the Superior Court for Lower Canada rendered two judgments affecting said Canada patent, to the purport set forth in the plea and the answer.

The stipulation further provided that, if the decision of the Circuit Court should be in favor of the plaintiff, it should have a reasonable time thereafter to file a replication to the answer, and the cause should proceed in the ordinary manner; that, if the Circuit Court should decide the cause in favor of the defendant, a decree should be entered dismissing the bill, so that the plaintiff might take an appeal therefrom to the Supreme Court of the United States; and that, if the Circuit Court should decide the cause in favor of the defendant, and the Supreme Court of the United States should, on appeal, reverse that decision, the defendant should have a right to proceed in the Circuit Court, under its answer, as to all defenses set up therein, except the one mentioned in the stipulation, as it might have proceeded if the stipulation had not been made.

The cause was heard on the pleadings and stipulation, and the Circuit Court entered a decree dismissing the bill, from which decree the plaintiff has appealed to this court. The Circuit Court gave no opinion on the merits of the case, but in deciding it followed, as it stated, the decision of the Circuit Court of the United States for the District of New Jersey, held by Mr. Justice Bradley, in Aug., 1887, made in the case of *Bate Refrigerating Company vs. Gillett* (31 *Fed. Rep.*, 809).

The questions discussed at the bar arise under section 4,887 of the Revised Statutes, which is as follows: "No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid, by reason of its having been first patented or caused to be patented in a foreign country, unless the same has been introduced into public use in the United States for more than two years prior to the application. But every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force for more than seventeen years."

Two propositions as to the construction of this section are contended for by the appellant: (1) That the words "first patented or caused to be patented in a foreign country" do not mean "first patented or caused to be patented" before the issuing, or granting, or date, of the United States patent, but mean "first patented or caused to be patented" before the date of the application of the United States patent; (2) that the declaration of the section that "every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or, if there be more than one at the same time with the one having the shortest term," does not mean that the patent so granted shall expire at the same time with the term to which the foreign patent was in fact limited at the time the United States patent was granted; but that it means that it shall expire when the foreign patent expires, without reference to the limitations of the term of such foreign patent in actual force at the time the United States patent was granted.

We do not find it necessary to consider the first of these questions, because we are of opinion that the proper construction of Section 4,887, upon the second question is, that the patent in the present case does not expire before January 9, 1892, the time when the Canadian patent, No. 6,938, will expire.

The Canadian patent was extended for the two periods of five years each, under the provisions of Section 17 of the Canadian Act assented to June 14, 1872 (35 *Victoria, Chap.* 26), which was in force when the United States patent, No. 197,314, was applied for and granted, and which reads as follows: "17. Patents of invention issued by the patent office shall be valid for a period of five, ten, or fifteen years, at the option of the applicant, but at or before the expiration of said five or ten years the holder thereof may obtain an extension of the patent for another period of five years, and after those second five years may obtain a further extension for another five years, not in any case to exceed a total period of fifteen years in all; and the instrument delivered by the Patent Office for such extension of time shall be in the form which may be from time to time adopted, to be attached, with reference to the patent and under the signature of the Commissioner or of any other member of the Privy Council in the case of the absence of the Commissioner."

This statute appears to have been strictly complied with in the present case. The Canadian patent, No. 6,938, ran, on its face, for five years from Jan. 9, 1877, and, prior to the expiration of that time and on Dec. 5, 1881, Bate applied for its extension for ten years; and it was, before the five years expired, and on Dec. 12, 1881, extended for five years from Jan. 9, 1882, and on Dec. 13, 1881, for five years from Jan. 9, 1887. The Canadian patent, therefore, has never ceased to exist, but has been in force continuously from Jan. 9, 1877. It was in force when No. 197,314 was issued; and it has, by virtue of a Canadian statute, in force when the application for No. 197,314 was filed, continued to be in force at all times since the latter patent was granted. This is true, although the Canadian patent, No. 6,938, as originally granted, stated on its face that it was granted "for the period of five years" from January 9, 1877; and although the instrument granting the first extension of five years states that it is granted "for another period of five years, to commence and be computed on and from the ninth day of January, which will be in the year one thousand eight hundred and eighty-two; and although the instrument granting the second extension of five years states that it is granted "for another period of five years, to commence and be computed on and from the ninth day of January, which will be in the year one thousand eight hundred and eighty seven." By the language of Section 17 of the Canadian Act of 1872, what was granted under it was "an extension of the patent"—of the same patent—for a further term. Therefore the Canadian patent does not expire, and it never could have been properly said that it would expire, before Jan. 9, 1892; and hence No. 197,314, if so limited as to expire at the same time with the Canadian patent, cannot expire before Jan. 9, 1892.

Section 6 of the Act of March 3, 1839 (5 Stat. 354), provided that a United States patent for an invention patented in a foreign country more than six months prior to the application of the inventor for the United States patent should be limited to the term of fourteen years from the date or publication of the foreign patent. Section 25, of the Act of July 8, 1870 (16 Stat. 201), provided that the United States patent for an invention "first patented or caused to be patented in a foreign country," should "expire at the same time with the foreign patent, or if there be more than one, at the same time with the one having the shortest term; but in no case shall it be in force more than 17 years." Section 4 887 of the Revised Statutes provides, that "every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force more than seventeen years."

These provisions of the Act of 1870, and of the Revised Statutes, mean that the United States patent shall not expire so long as the foreign patent continues to exist, not extending beyond seventeen years from the date of the United States patent, but shall continue in force, though not longer than seventeen years from its date, so long as the foreign patent continues to exist. Under Section 4,887, although, in the case provided for by it, the United States patent may on its face run for seventeen years from its date, it is to be so limited by the courts, as a matter to be adjudicated on evidence *in pais*, as to expire at the same time with the foreign patent, not running in any case more than the seventeen years; but, subject to the latter limitation, it is to be in force as long as the foreign patent is in force.

A contrary view to this has been expressed by several Circuit Courts of the United States.

In October, 1878, in the Circuit Court for the District of Rhode Island, in *Henry vs. Providence Tool Company* (3 *Ban. & Ard.*, 501), it was held that the 25th section of the Act of July 8, 1870, meant that the United States patent should expire at the same time with the original term of a foreign patent for the same invention, without regard to any prolongation of the foreign patent which the patentee might procure from the foreign government. In that case the United States patent was granted Oct. 10, 1871. A British patent for the same invention had been granted to the patentee on the 15th of November, 1860, for fourteen years, and expired Nov. 15, 1874. Thirteen days after the latter date an order was made for the extension of the British patent for four years, the extension bearing date as of the day after the expiration of the original term; but the Court held that the United States patent expired on the 15th of November, 1874.

That decision was followed by the Circuit Court for the Southern District of New York, in *Reissner* vs. *Sharp* (16 Blatchford, 383), in June, 1879, which case arose under Section 4887 of the Revised Statutes. In that case the United States patent, granted Oct. 20, 1874, for seventeen years, was held to have expired on the 15th of May, 1878, because a patent was granted in Canada, under the authority of the patentee, for the same invention, on the 15th of May, 1873, for five years from that day, although in March, 1878, the Canada patent was extended for five years from the 15th of May, 1878, and also for five years from the 15th of May, 1883.

In *Bate Refrigerating Company* vs. *Gillett* (13 Fed. Rep., 553), in the Circuit Court for the District of New Jersey, in August, 1882, and in the same suit, in the same Court, in August, 1887 (31 Fed. Rep., 809), in regard to the patent in question in the present suit, and on the same facts here presented, it was held on the strength of the two Circuit Court cases above referred to, that the United States patent expired when the original term of the Canadian patent expired.

But we are of opinion that, in the present case, where the Canadian statute under which the extensions of the Canadian patent were granted was in force when the United States patent was issued, and also when that patent was applied for, and where by the Canadian statute, the extension of the patent for Canada, was a matter entirely of right, at the option of the patentee, on his payment of a required fee, and where the fifteen years term of the Canadian patent has been continuous and without interruption, the United States patent does not expire before the end of the fifteen years' duration of the Canadian patent. This is true, although the United States patent runs, on its face, for seventeen years from its date, and is not, on its face, so limited as to expire at the same time with the foreign patent, it not being necessary that the United States patent should, on its face, be limited in duration to the duration of the foreign patent.

In *O'Reilly* vs. *Morse* (15 How., 62), the patent to Morse was issued June 20, 1840, for fourteen years from that day, while

§ 6 of the act of March 3, 1839 (5 Stat., 354), was in force, which required that every United States patent for an invention patented in a foreign country should be "limited to the term of fourteen years from the date or publication of such foreign 'letters patent.'" Morse applied for his United States patent April 7, 1838. He obtained a patent in France for his invention Oct. 30, 1838. The objection was taken in the answer that the United States patent was void on its face because not limited to the term of the French patent. The Circuit Court held that the patent was not void, but that the exclusive right granted by it must be limited to fourteen years from Oct. 30, 1838. The same objection was urged in this court, and the same ruling was made. In Smith vs. Ely (15 How., 137), which was a suit on the same patent, under the same facts, the same question arose and was decided in the same way. A full and interesting discussion of the question is to be found in *Canan* vs. *The Pound Manufacturing Company* (23 Blatchford, 173), in regard to § 4887, which contains the same word "limited" found in § 6 of the Act of 1839, which word is not found in § 25 of the Act of July 8, 1870, from which § 4887 was taken.

Under this view the time of the expiration of the foreign patent may be shown by evidence *in pais*, whether the record of the foreign patent itself, showing its duration, or other proper evidence, and it is no more objectionable to show the time of the expiration of the foreign patent by giving evidence of extensions such as those in the present case, and thus to show the the time when, by virtue of such extensions, the United States patent will expire.

We find in the record in this case, among the papers which it states were submitted to the court under the stipulation above referred to, a certificate of the Commissioner of Patents, dated July 3, 1883, appended to a certified copy of the United States patent, stating that the term thereof is limited so that it shall expire with the patent obtained by the patentee in Canada, No. 6988, dated Jan. 9, 1877, for the same invention; that the proper entries and corrections have been made in the files and records of the Patent Office; that it had been shown that the original patent had been lost, and that the certificate is made because that patent was issued without limitation, as required by Section 4887 of the Revised Statutes. While it may be proper, in a case where the date of a foreign patent, issued prior to the granting of a United States patent to the same patentee for the same invention is made known to the Patent Office prior to the granting of the United States Patent, to insert in that patent a statement of the limitation of its duration, in accordance with the duration of the foreign patent, it does not affect the validity of the United States patent if such limitation is not contained on its face.

It results from these views, that the decree of the Circuit Court must be reversed, and the case be remanded to that Court, with a direction to take such further proceedings as shall be in accordance with law and with the stipulation between the parties above referred to, and not inconsistent with this opinion.

The Edison counsel in this city announce that they have obtained an order from Judge Wallace in the U. S. Circuit Court for the Southern District of New York, in this city, returnable Friday of the present week, calling upon companies affected by the infringement suits pending here, to show cause why, in view of the above decision, they should not now be proceeded against in the usual way.

Another Sprague Road in the South.

The first trial trip of the Sprague cars on the Asheville, N. C., Electric Street Railway was made on Jan. 21, in presence of the president, Mr. W. P Penniman, Jr., Superintendent Mr. J. H. Barnard, and a number of prominent citizens—Captain T. W. Patton, General Johnstone Jones, Dr. S. D. Pelham and about sixty others, some being stockholders in the road, and others interested directly or indirectly in the success of the enterprise.

The test proved a great success. The run was made over the entire distance of the line, about two miles, in less than eight minutes, carrying a large number of passengers. Upon reaching the terminus of the line, which is at the new W. N. C. Railroad Depot, the party were welcomed by cheers from the citizens who had gathered to greet their arrival, and by blowing of whistles from all the locomotives at the depot.

The citizens of Asheville are enthusiastic over the new electric line, and the directors of the road express themselves as very well pleased with the successful performance of the motor cars.

The *Asheville Citizen*, in speaking of the road, says: "Hurrah for the Asheville Street Railway. The enterprise is a great one for Asheville, and all honor and credit to its projectors and owners. The Asheville Electric Street Railway is a great success, and we would like to say that there are no *muscæ domesticæ* on the Asheville Electric Street Railway or upon those who control it.

A Sprague Road for Atlantic City, N. J.

News reaches us of a very important indorsement of the electric system of street railway propulsion over all others. This indorsement comes from the Pennsylvania Railway Company, who have during this last week, through their general manager, closed a contract with the Sprague Electric Railway and Motor Company for the complete equipment of their system of electric street railways at Atlantic City, N. J. Before awarding this contract for the equipment of this road, the Pennsylvania Railroad appointed a committee to make a most minute and careful investigation of the merits of all the different systems of street railway propulsion, both electric and cable, now in use. The committee in charge of the investigation were composed of mechanical and electrical experts of the highest class and of wide reputation. The period of investigation extended over five months, and during this time the committee visited all the principal electric railways and cable roads which are in operation in this country and carefully examined the operation of each. The Sprague Company are certainly to be very highly complimented upon securing this contract, and taking into consideration the high attainments and reputation of the judges, it is one of the most important and convincing indorsements which could be given.

The National Electric Light Convention.

The Chairman of the Executive Committee of the National Electric Light Association reports the following progress with regard to the coming Convention:

The Board of Directors of the Exhibition Company have contracted to spend $1,500 in putting in steam heat in the art rooms and large dining hall that are to be used by the electric light people. Only one-third of this sum is paid over by the Electric Light Association, and the remainder is practically offered as a bonus to secure the meeting. The directors are very much interested in the exhibit features and are offering every facility to make it a complete success. As has been stated before, they are desirous, some time in the early future, say a year hence, of having an electric exhibit that will completely fill the great building and will include everything in the line of electric manufactures.

The large space at the disposal of the committee is practically spoken for now, and it will be quite difficult to arrange for any more space in the rooms taken. The Thomson-Houston Electric Railway and a car equipped with storage batteries will be the features in the line of electric railways. The motor service will be represented by Thomson-Houston, Baxter, C. & C., Brush, Belding and Eddy. Arc light systems in practical operation will be the Thomson-Houston, Brush, Sperry, Excelsior and perhaps one or two others. At least three companies will illustrate in practical operation their incandescent systems.

The tickets of admission are now being printed, and will be ready for distribution inside of a week. One hundred thousand tickets have been ordered, but this number will probably not be sufficient if the demands of the exhibitors for tickets for their friends and correspondents made up to this date is any criterion.

Among other exhibits to be made are those of the Non-Magnetic Watch Company and the Phœnix Glass Company, and the appearance of the rooms will be very much beautified by the addition of the resplendent wares of the electrolier manufacturers.

Applications for hotel accommodations are being made daily and from all indications there will be a very large attendance of ladies.

The 900 feet of track for the electric railway will be laid in a week. This work is being done by Mr. C. B. Holmes, of the Chicago City Railway Company, whose interest in the advancement of the science of rapid transit, especially from the electrical standpoint, is well known. The track will have one curve of 50 feet radius, so that the electric railway men will have an opportunity to show how their respective systems perform on a curve.

Presentation to Mr. W. J. Dealy.

Another of the popular and successful quarterly dinners of the New York Magnetic Club was given at Martinelli's Fifth avenue restaurant on Jan. 23, when over 80 members and friends assembled. President C. P. Bruch was in the chair, and he was well supported by the officers of the club, whose efficiency in managing these pleasant affairs was again signally displayed. After dinner three or four hours were spent most agreeably in listening to speeches, songs, recitations and instrumental performances. The event of the evening, however, took the shape of a surprise to Mr. W. J. Dealy, vice-president of the club. There is no one more esteemed in the telegraphic profession in this country to-day than Mr. Dealy, who has risen from rank to rank until he is now the popular manager of the vast operating department at the W. U. main office, 195 Broadway, with a staff numbering hundreds, every member of which feels that in Mr. Dealy he has at once a vigilant chief and a kind personal friend. The sentiment of the office, therefore, found appropriate expression when Mr. E. F. Howell, in the name of his associates and in a felicitous little speech, presented Mr. Dealy with a splendidly framed large photograph, being a group of the sixty-five chief operators, ladies and gentlemen, employed at "195." Mr. Dealy's acknowledgment was exceedingly happy, and the occasion was marked by the outburst and display of deep-seated emotion and enthusiasm on all sides. Altogether the evening was most memorable and enjoyable. The next meeting of the club will be a "Ladies' Evening," when the ladies will not only be entertained at a reception, but will themselves contribute to the programme.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Jan. 28, 1889.

Distinguished Visitors.—Among the recent callers on the Daft Electric Company were the Duke don Pedro de Bourbon, first cousin to the late King of Spain, and Chevalier Francis Camberling, inquiring into the methods of applying electricity for light, heat and power.

Big Belts.—Some very big cotton leather belts have just been sold by Mr. A. B. Laurence for electrical purposes. They are 11 inch, 55 feet "endless," and two 9-inch "dynamo," 43 feet, for the big Edison plant in the Central Railroad Building, Jersey City. A 6-inch belt of the same make has just gone to the C. & C. Motor Company.

The Phœnix Glass Company, of 729 Broadway, have just issued a new and magnificent catalogue of their arc and incandescent globes, shades, etc., in rich cut, decorated, opalescent and other art glass effects. The man who cannot be suited from this collection must indeed be hard to please, and one can hardly imagine such a being to exist. Still, special shapes are readily made to order.

The American Cold Storage and Refrigerating Company are, I note, preparing actively for extensive operations in the field of ice making and the supply of refrigerating machines under the Winkler and Wood patents. Among the gentlemen connected with the company is Mr. H. A. Alexander, who is also prominently interested in the Composite Cell Company, of which I have already made note.

The West Side Electric Light and Power Company has offices at 502 West 53d street. Its officers are: E. L. Striker, president; Hon. J. Quinn, vice-president; H. B. Russ, treasurer, and W. S. Taber, secretary. Mr. W. H. Cole is the electrical engineer and superintendent. Mr. Cole also does general expert and testing work, and makes a specialty of the transmission of electricity for light and power.

Mr. L. H. Rogers, of the Electrical Accumulator Company, has the management of all temporary installations of this company. He put in lately 100 lights for W. S. Webb and Cornelius Vanderbilt, and now has a plant in hand for the home of Elbridge T. Gerry, 8 East Forty-eighth street, where he expects to improve upon the pretty effects of work at the two above places. There will be 72 cells of battery used, and about 100 lamps of 16 c. p.

Mr. Charles Wann, I am pleased to see, having resigned from the Union Fire Alarm Campany, has taken a more congenial position with the object of introducing to public notice the system of the New York Thermostatic Fire Alarm Company of 338 Broadway. This system, which works on closed circuit, is the invention of Mr. W. J. Frost, and bids fair to be widely introduced in the large stores, warehouses, etc., of our big cities and manufacturing centres.

The Railway Cab Electric Signal Company, of 42 Broadway, is in the hands of Deputy Sheriff Carraher on executions aggregating over $5,000, the largest being in favor of H. H. Wood for $2,154. The company was incorporated in 1882 with an authorized capital of $1,000,000, all of which was issued for patents. The company did not meet with much success in developing the business. Conrad N. Jordan was formerly president, but resigned several years ago. The assets of the company, it is said, are merely nominal.

The Bentley-Knight Railway System.—I dropped in a few days ago at the new factory of the Bentley-Knight Electric Railway Company, 25 and 27 Tenth avenue, where I found Mr. R. W. Blackwell, busy as ever, surrounded by clerks, draughtsmen and engineers, in his fine offices on the fourth floor. Plans are in course of preparation for a number of new roads. On the floors below a number of artisans and mechanics were busy on dynamos and motors, and a number of handsome cars were being fitted up for the West End road in Boston.

The Empire City Electric Company, with the direction of Gen. O. E. Madden and Mr. E. T. Gilliland, is making a fine record in the supply business. It is still young, but is already widely known, and is adding steadily to its force and to its customers. No small share of the credit for the popularity of the house is due also to the exertions of Mr. E. W. Carritt, the secretary and treasurer. General Madden, taking hold a year ago, did much to put matters in shape and to lay out the work, so that now under the more active management, in the lines of telegraphy, telephony, electric light and power and general supplies, the company are as busy as they can be.

The Boys Listened Quietly.—Between 200 and 300 messenger boys listened quietly and with some show of interest to a spirited address by Cleveland H. Dodge in Association Hall, this city, one night last week. There was no attempt at guying on the part of the boys, and, with two or three exceptions, no manifestations of a disorderly spirit. Mr. Dodge talked to the boys about baseball, military heroes, and the necessity of leading honest and industrious lives. After he had finished there was a humorous recitation by young Master Charles Hanson. A drill by the Knights of Temperance completed the evening's exercises.

Personal.—Mr. Edward E. Britton, electrician, at one time connected with a storage battery concern in Beekman street, has taken the management of the New York department of the Van Depoele electric light business, with offices at 234 Broadway, where he will be glad to see all his old friends in regard to light and power plants.

Mr. C. D. Bernsee, sole agent for the Eco magnetic clock, office in the Potter building, has the Eco watchman's clock on exhibition there. He has met with unprecedented success in the introduction of the clock, and a new prospectus just issued by the company shows over forty of the largest factories in the country using the system and operating it to their entire satisfaction. Among such well-known concerns may be mentioned the Standard Oil Company, the Brockton Electric Company, the Standard Electric Time Company of New Haven, the Novelty Electric Company, of Philadelphia.

The Zucker & Levett Chemical Company, of 36, 38 and 40 Eleventh avenue and West Sixteenth street, this city, have built up an enormous business as manufacturers and dealers in electroplaters' supplies and polishing materials. Their handsome new catalogue consists of no fewer than 56 pages, and it embraces not only full descriptions of apparatus, but some extremely valuable data, advice and information pertaining to the electroplating and electrotyping art. Their polishing materials and muslin buffs there enumerated are favorably known to, and used by, many of the largest houses in the country, while together with such specialties as their pure refined nickel anodes and salts. They are the sole manufacturers of the well-known American "Giant" dynamo-electric machines, which have proved so serviceable in plating work and which are now to be found in every section of the country. I should recommend all interested in this line of work to get a copy of the catalogue and to make a practical acquaintance with its contents.

The C. & C. Motor Company, having moved into their superb new factory at 402 and 404 Greenwich street, this city, gave a press reception there last week which was well attended. This factory is not only used for the manufacture of the C. & C. motors, thousands of which have now been made and sold, but for other purposes where power is required, the power in each instance being furnished by C. & C. motors in any size or number required. This is the only plant of the kind in existence, I believe, for such work, but it is so successful from the very start that there will soon be a great many others like it. The current is generated in the basement by a 50,000 watt Edison dynamo, and is thence carried to the motor driving the machinery on each floor. The construction of the building is as massive and solid as it could possibly be, and good engineering work is seen on every hand. On the various floors occupied by the C. & C. Company, the tools and appliances are of the latest and best, and the system of production that has been elaborated is well thought out, leading to great economy in the various processes of manufacture. One good point in the C. & C. motors, beyond their electrical excellence, etc., is the fact that they are made "interchangeable" in all their details. The company are now building a new type of double field magnet for their larger sizes, in which their orders are growing rapidly.

The New York Insulated Wire Company have leased a fine large building at Wallingford, Conn., 306 feet long, 40 feet wide and 4 stories high, on the line of the New York, New Haven & Hartford Railroad. They will have a branch road running into the grounds of the factory, so that goods can be handled very conveniently. The nearness of the factory to New York is also a great advantage. The company are doing an immense business in the finer grades of insulated wires. Their product has been used in a number of the new large buildings in New York and its vicinity, such as the *Times*, the United States Trust Company's, now being wired by Mr. G. H. Pride; the Central Trust Company's, 51 Wall street; Proctor's new theatre, Twenty-third street, now being wired by A. Noll & Co.; and the big Striker flats uptown. Even these few represent hundreds of thousands of feet. Out of town, too, are a great many places, such as the new building of the New York Life Insurance Company in Kansas City, now being wired with "Grimshaw" for the Brush system. The New York Insulated Wire Company are nicely settled in their new offices, 649 and 651 Broadway, running through to Mercer street, well lighted and ventilated. The salesrooms are now being stocked with a fine line of the wires, tapes, cables, etc., made by the company, and opportunity is afforded for tasteful display of these well-known and deservedly popular goods.

The Webb Ball Room.—The following are the main points furnished by Mr. G. B. Prescott, Jr., electrician, in relation to the temporary installation of accumulators at Dr. Webb's ball on last Friday evening, of which I made mention in my notes: There were two series of thirty-five cells each, of the Electrical Accumulator Company's "15A" cells, which were connected in parallel and supplied current for ninety 16 c. p. lamps from 6 o'clock in the evening until 4 o'clock in the morning. These cells were charged at the company's works at Newark and carted to Dr. Webb's residence on the day of the ball, where they were placed in the basement. The lamps were used for the illumination of the ball-room and the banquet hall. In the former there were sixty (60) lights, which were suspended from the cornices and formed a border on four sides of the room. Beneath the lights was stretched a width of very thin transparent pongee silk, which agreeably tempered the light and gave it a pink tinge. The ceiling and walls of this room are very handsomely frescoed and the light illuminated the paintings so effectively that they displayed beauties that had not before been noticed by the family. In the dining hall there were thirty lights distributed in a somewhat similar manner, the lamps being inclosed in decorative globes, some of cut-glass, and others opal, arranged uniformly between the carved panels on the wall. The effect in both rooms was magnificent and no accident or hitch of any kind occurred.

The Woodward Storage Car in Brooklyn.—Last week I had the pleasure of inspecting the car equipped with the Detroit storage battery made by the Woodward Electrical Company, of Detroit, which is now in operation on the "dummy" road in Brooklyn, running on Third avenue from Twenty-fifth street to Bay Ridge, South Brooklyn. While there I met Mr. Frank B. Trout, general manager of the Woodward Company, Mr. A. A. Ingraham, the owner of the car and the equipment known as the "friction system for electric motors;" and his agent, W. H. Taylor, having offices, 55 Broadway. Mr. D. H. Washburn, electrician, was our informant on the salient features of the systems, which are novel in many respects. Mr. A. J. Vercouterin, an expert, representing a syndicate in the south who intend developing electric light, heat

and power there, was also an attentive examiner. The car is equipped with 84 cells, with hard rubber jars, having a capacity of 300 ampère-hours. Each cell has 17 plates, but a larger size containing 19 plates and having a capacity of 400 ampère-hours will shortly be placed on the car. A series motor is placed under the car, which is mounted on six wheels, and the power is transmitted from the motor to the axles by means of two friction wheels. Two pairs of wheels are movable, and connected to a lever on the platform. When said lever is operated the movable pairs of wheels are brought up to the friction wheels, attached to the motor shaft between them, and the car is thus set in motion. By this means the start can be made very gradually, though quickly, and without jar or shock. On the platform are also placed a main battery switch and regulating switch. The arrangement is such that when the brake lever is applied the batteries are automatically cut out at the same time. When starting the brake lever is released by the foot, while at the same time the batteries are again automatically placed in circuit, and the car starts with the full power. The car is brilliantly lighted by three 16 c. p. incandescent lamps, and is expected to overcome the difficulties heretofore met with in this method of traction.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, 146 Franklin St, and 149 Congress St.
BOSTON, Jan. 28, 1889.

Electric Lights for Dedham.—The Dedham (Mass.) Water Company has petitioned the Legislature for an amendment to its charter, granting it the right to generate power and to furnish electric lights in the town named.

Revere to Have Electric Lights.—At the town meeting at Revere, Mass., on the evening of Jan. 21, the town treasurer was authorized to borrow $18,000 and to expend this amount in a complete plant for electric lighting purposes. It has not yet been decided which system will be used.

Proposed Lynn Electric Road.—Prominent business men of Lynn, Mass., have subscribed $50,000 to promote the enterprise of an electric railway between the city named and the attractive seaside resort Nahant. The stockholders will endeavor to get permission to build and operate the electric road at the town meeting in Nahant in March.

Spencer Damper Regulator.—Mr. G. G. Stillman, of 19 Pearl street, reports the following sales: Dover (N. H.) Electric Light Company; Lynn (Mass.) Electric Light Company; Thomson-Houston Company, Lynn, Mass.; Beverley (Mass.) Electric Light Company; Amesbury (Mass.) Electric Light Company; Edison Company, Newport, R. I.

The Electric Gas Lighting Company, of this city, find their beautiful new catalogue in great demand. Among the leading new specialties therein described are the "Star" electro-mechanical gong, the automatic sectional cut-out, the "Triumph" automatic burners and the now widely-known "Samson" battery, of which so many electricians speak in high praise.

Vacuum Oil.—Mr. P. D. Richard, the Boston agent of the Vacuum Oil Company, of Rochester, N. Y., favored me with a visit one day last week. Mr. Richard has, until recently, been identified with several electric light enterprises, and has large acquaintance among the electrical fraternity. The meritorious oil Mr. Richard is agent for is well worthy the consideration of electric light superintendents.

Personal.—Mr. C. H. Macilile, formerly the Western agent of THE ELECTRICAL WORLD, and at present connected with the *Electrical Engineer*, was in Boston several days during the past week.

Mr. Chas. E. Bibber, for a long period the traveling representative of the recently dissolved firm of Fuller, Holtzer & Company, is now connected in a similar capacity with the new firm, Messrs. Holtzer & Cabot, manufacturers, importers and dealers in electrical apparatus, No. 111 Arch street, Boston. Mr. Bibber will start this week on a business trip through the West and Southwest.

American Steam Gauge Company.—The 35th annual meeting of the American Steam Gauge Company was held last week at the Revere House. Hon. J. C. Blaisdell, of Fall River, presided, and there was a fair attendance of the stockholders. Officers were elected as follows: President, J. C. Blaisdell; treasurer, E. Burt Phillips; clerk of corporation, E. P. Barrett; directors, J. C. Blaisdell, E. Burt Phillips, George Briggs, William H. Phillips and H. K. Moore. By the report of the treasurer the company was shown to be in a prosperous condition. A dividend of five per cent. was paid. Subsequent to the business meeting the annual dinner was partaken of.

The Inaugural Ball.—The committee in charge of this important affair has given the Thomson-Houston Electric Company an order for 1,000 incandescent lights and 20 arc lights for illuminating the spacious hall in the United States Pension Building in Washington, D. C., on the occasion of the inaugural ball on the evening of March 4. The entire equipment for the electric lights will be shipped direct from Boston, all in shape for immediate installation on its arrival at the Capitol City. An engine of 125 h. p., of the McIntosh & Seymour type, will be used. Mr. C. B. Burleigh, of the Thomson-Houston Electric Company, will have charge of the installation.

Telephone Combination.—A dispatch from Halifax, N. S., under date of Jan. 23, states that "at a special meeting of the Nova Scotia Telephone Company, this afternoon, it was decided to sell the company's interests in New Brunswick to the Bell Company of Canada, by which company they are to be transferred to the New Brunswick Company. The Nova Scotia Company also resolved to enter into combination with the Bell Company of Canada, the American Bell Company of the United States and the New Brunswick Company, whereby the lines of all will connect with one another and no opposition line will be allowed to connect."

The Boston Electric Club.—This organization will transfer its quarters on February 1 from No. 66 Boylston street to No. 7 Park street. The new club rooms will be in every respect more desirable than those previously occupied. From the front parlors an extended view is had of the Common and Tremont street. The building is only a few steps from the thoroughfare named; and is only a half block from the State House. The Parker House and Tremont House are just around the corner, and Young's Hotel is only two blocks distant. The new quarters are being fitted up and furnished in an attractive manner by the energetic House Committee of the club, Messrs. Jno. C. Wilson, Otis K. Stuart, John Post, Jr., Wm. C. Woodward, and J. R. Lovejoy.

A Compound Condensing Plant.—The motive power for the electric service of the West End Railway lines in Cambridge is obtained from the new station of the Cambridge Electric Light Company on River street, and the location being close to the tide water admits of the plant being run on the compound condensing system. The above company is taking advantage of the opportunity of effecting a large reduction in coal bills, and is adopting the McIntosh, Seymour & Co. compound engines arranged to belt direct to the generators, two of the generators to each engine. This plan, in addition to the saving effected, admits of only the amount of engine power being used as called for by the requirements of the railway service, which, of course, varies largely during the day.

The Sprague Electric Road.—The West End Electric Railway is running very successfully, and carrying a large number of passengers each day between Park square, one terminus of the road, and Brighton, the other terminus of the road. The cars run speedily, and are under very quick and perfect control. The residents in Brookline who used the cars regularly in coming into Boston and returning are very enthusiastic over the celerity of the cars, and the time saved over the ordinary horse-car. The change of the overhead to the underground system is made very quickly and without stop, so that no delay is experienced at this point. The car drivers, or "motorneers," as some Bostonians persist in calling them, are not expert electricians, but simply street-car drivers, who have been detailed to operate the electric cars, and who have learned their necessary duties very quickly. All of these old drivers are very enthusiastic over the ease with which an electric car can be driven, and are very well pleased with their new position. On the 20th of January a very heavy snow storm reached the city and covered the tracks of the railway to the depth of from two inches to a foot. The electric snow-plows which are being equipped by the Sprague Company for use by the West End road, had not been finished, and the cars were obliged to run without this aid for clearing the tracks. In spite of this, the cars ran very successfully over the entire distance of the roads, clearing their own way, and carrying large numbers of passengers. The president of the road and the directors expressed themselves as very well pleased with the demonstrated efficiency and strength of the electric road, as exhibited during the snow storm, even without the aid of the regular electric snow-plows.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 City Trust Building, Philadelphia, Pa., Jan. 26, 1889.

A Lecture upon "Edison and His Inventions" will be given at the Franklin Institute rooms on Monday evening, Feb. 4. Illustrations will be given by means of the stereopticon.

A Good Belt for running dynamo pulleys is certainly a desideratum, and Messrs. Pechin & Bro. are congratulating themselves that their dynamic belt is giving good satisfaction. Judging from their order book, the belt is certainly a marketable commodity.

The Leber Incandescent Lamp.—Efforts are being made among capitalists of this city to form a company to push the Leber combination incandescent lamp. This device, by an ingenious arrangement of carbons and switches, will emit light at various candle-powers. The 8-16-32 c. p. lamp is the favorite at present.

Underground Wires.—To the Electrical Committee of Councils has been referred ordinances, submitted by President Wagner, of the Board of Highway Supervisors, permitting the Frankfort Avenue and the Eighth Street Electric Light companies to lay and maintain underground conduits and wires in certain streets designated in each company's charter.

The Reliance Electric Company.—A new candidate for local construction work has arisen in the Reliance Electric Company, of which W. Monkhouse is president and general manager. The company have several large contracts on hand, and are negotiating for others that will insure work for at least a year. Mr. Monkhouse is preparing to erect a shop for the manufacturing of electrical supply goods and novelties.

Partrick & Carter, the well-known manufacturers of electrical goods, are constantly receiving communications asking for bids on construction work, whereas they are strictly a manufacturing concern. Mr. Wilkins says that purchasing agents and others could save themselves considerable trouble, by remembering that his firm does no constructing of any character, and can merely refer their letters to parties whom they know to be competent.

The Wissahickon Electric Light Company held its annual meeting on the 21st inst. at its office, corner of Ridge avenue and Sumac street, and elected the following officers for the ensuing year: President, William Johnston; vice-president, Leander M. Jones; secretary and treasurer, Charles K. Smith; manager, James Christie; directors, William Johnston, Charles K. Smith, James Christie, Leander M. Jones, Isaac Wilde, Peter Libert and H. R. Shultz.

Chief Inspector McDevitt, of the local Fire Insurance Patrol, in his annual report, calls attention to the careless work of wiring private houses and the growing danger from fires arising from incompetent work. The percentage of fires during last year from this cause was greatly in excess of the year previous; all of which tends to prove that the presence of a competent and careful person to superintend construction work should be one of the specifications in every contract for wiring.

The Electric Motor as a power for running elevators has been given a practical indorsement through the efforts of the Morse Elevator Works, of this city. By a series of experiments this enterprising firm has obtained results which settle the most intricate questions connected with such a combination. They have been eminently successful with the Sprague motor, but do not limit themselves to any special machine. Any inquiries concerning this motor will be most cheerfully acknowledged by Mr. Charles Williams, of Morse, Williams & Co.

Lieut. J. Veeder, U. S. N., who has been assigned by Secretary Whitney to inspect the electrical apparatus on the new vessels now being built for the navy, is at present stationed in this city. All the Government ships in process of construction at Cramp's shipyard, in this city, and Roach's shipyard at Chester, are being fitted with arc and incandescent plants, the arc lamp being used for search and mast lights, while the incandescent lamp will be used below. Lieut. Veeder is a practical electrician and is considered admirably qualified for the duties allotted him.

The Edison Electric Lighting Station, which is being constructed on Sansom street, will probably not be completed before April 1, at the present rate of working. When the ground was first broken for the foundation, the date set for completion was November 1, 1888. This interesting event has been postponed a month at a time, until the date now published is still eight weeks off. This delay has proved of considerable annoyance to persons who had their houses wired in anticipation of the electric meter replacing the deadly gas register during the long winter months. They live in hope, however, that the transition from the ancient to the modern system of house illumination will be a sufficient recompense for their lost patience. This station differs somewhat from the ones in New York, but the general lines are similar. A monster generator, with an efficiency of 1,000 amperes, was received at the station last week, and when placed in position towered majestically above everything else in the room. The arrangements of the dynamos will differ from the disposition of the machines at the New York station, in that the armatures can be removed without disturbing any other machine in the room.

The Harrisburg Electric Light Company has been awarded a verdict in its suit against B. & E. Goodman, a clothing firm of that city, and an interesting and important question has been judicially settled. It appears by the testimony, that the defendants ceased using the light furnished by the company, but refused to permit the removal of the electric fixtures, retaining them for use by a rival corporation which was introducing its system. The nominal value of the property retained was only about $10, but the question arose as to whether the rival Excelsior Company could appropriate to their use the wire of a competing company without compensation by the tenant of the lessee claiming the wires. The verdict of the court was a complete vindication of the rights of the Harrisburg company, awarding them not only the entire property, but a judgment for $50, the excess $40 as damages. The principle determined by this case is that a company which lets or hires its electric wires, fixtures, or appliances to another for use and reserves the right to remove the same, preserves its ownership as personal property, notwithstanding the wires may be covered up in the ceiling and fastened to the floors and walls of the building, as in this instance.

The National Electric Light and Power Company was organized in this city last Wednesday. The stockholders met and formed a permanent organization by electing William T. Anderson vice-president; Hon. George F. Leland, treasurer; J. Clayton Erb, secretary, and Edmund Allen, H. E. Robinson, J. W. Johnson, William T. Anderson, G. F. Leland, Robert L. Cohen, J. Clayton Erb, directors. Mr. Edmund Allen, of Allen, Lane & Scott, was chosen temporary president until the next meeting, on the 30th instant, when General Merrill will probably be called to the head. The company is chartered under the laws of this State, with an authorized capital of $2,000,000. It was organized to place the Cohen dynamo and lamp on the market, and already has put in several plants in this city and Camden. A 200-light incandescent machine is now to be placed in the factory of Morse, Williams & Co.; a similar plant will be installed in Allen, Lane & Scott's business house, and the secretary, Mr. Erb, is negotiating for a 400-light plant, with every prospect of success. The Cohen dynamo has given satisfaction wherever it has been tried, and the prospect of good business for this company is encouraging. The office is in the Bullitt building.

E. F. C.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Jan. 26, 1889.

South Evanston, Ill.—The city has purchased 30 arc lights of the Excelsior system for street lighting.

Personal.—Mr. J. B. Wallace, of the Electrical Supply Company, was in the city for a few days last week.

Menominee, Wis.—Through the Chicago branch of the Excelsior Company, Mr. T. B. Wilson has purchased 300 incandescent lights.

Wabasha, Minn.—Mr. A. G. Lawrence has purchased a plant consisting of 300 incandescent lights of the Thomson-Houston direct system.

Mt. Vernon, Ill.—Mr. L. C. Tanner, of this city, has purchased a 15-light dynamo from the Western Department of the Excelsior Electric Company.

Electric Light for Photography.—E. A. Clements, a photographer of Chicago, has purchased a complete photographer's outfit from the Excelsior Electric Company.

Evanston, Ill.—The Northwestern University is to be lighted with a Mayo incandescent light, the contract for same having just been closed with the Van Depoele Company, Chicago.

Streator, Ill.—The Peoples' Electric Light Company, of this city have purchased of the Van Depoele Electric Manufacturing Company, of Chicago, a 500 incandescent plant of the Mayo system.

Wakefield, Mich.—The Washburn Mining and Milling Company have purchased for lighting their mines an incandescent plant of the Mayo system manufactured by the Van Depoele Company of Chicago.

The Midland Electric Company, of Omaha, Neb., has issued a very handsome chromolithographic calendar for 1889, showing a young and beautiful girl feeding a pet bird. The calendar pad is large and legible.

Wichita, Kan.—The Citizens' Electric Light Company, of this city, is to put in 1,300 lights of the Thomson-Houston alternating system. The order was placed through the Western Department of the Thomson-Houston Company.

For Lighting a Rubber Factory.—The Western Department of the Thomson-Houston Company has sold a plant, consisting of 200 lights of the direct incandescent system for lighting the works of the Chicago Rubber Company.

Personal.—Mr. P. C. Ackerman, of the American Electric Company, was in the city this week. Mr. G. L. Phillips, President of the Chicago Telephone Company, and one of his children are seriously ill with typhoid fever at his residence in Edgewater.

Bessemer, Ala.—J. H. Andrews, of New Orleans, La., has just purchased of the Van Depoele Electric Manufacturing Company, of Chicago, for the Bessemer Electric Light and Power Company, a plant consisting of 100 arc and 800 incandescent lights of the Mayo system.

Sales of Munson Belting.—The Charles Munson Belting Company report the recent sale of a 42-inch belt, 102¼ feet in length, to Geo. Seaverns, of Chicago, also two 22 inch belts, each 90 feet in length, to the Anglo-Swiss Condensed Milk Company, of Dixon, Ill.

Hard Rubber Goods for Electrical Purposes.—Mr. M. C. Chase, of this city, manufacturer of hard rubber goods, reports an active demand for battery cells and special work. The outlook, he thinks, is very bright for the latter class of work, which he makes specialty of.

A New Branch Office.—Under the management of Mr. F. P. Mack, the Underwood Manufacturing Company, of Tolland, Conn., have opened a branch office at 63 and 65 South Canal street, Chicago. This company, as is well known to the electrical fraternity, make a specialty of cotton leather belts for electric lighting service.

The Salisbury Motor Company.—The Salisbury Electric Street Motor Company, located at Chicago, has received incorporation license from the Secretary of State. The company purpose to organize for the manufacture and sale of electric motors; the capital stock is $250,000. The incorporators are Wilber S. Salisbury, Wm. Armstrong and Cyrus Vosburgh.

A Dynamo for Charging Storage Batteries.—With the use of the storage battery has sprung up a demand for a dynamo built with special reference to the requirements. The Van Depoele Company, of this city, announce themselves as being in the field

with a machine specially adapted for this purpose. They are prepared, I learn, to make any sized machine required.

A New Electric Light and Power Company in Chicago.—The Sperry Electric Light and Power Company, of Chicago, has received incorporation license from the Secretary of State, with a capital stock of $100,000. The incorporators are Samuel P. Parmly, Charles E. Gregory and Elmer A. Sperry. The company propose to establish in the meantime and operate electric light plants.

Train Lighting by Electricity.—Messrs. Leonard & Izard are equipping the trains of the C., M. & St. P. with incandescent lighting plant of a new system, for which patents are now pending. The first train so equipped left Chicago for St. Paul on the evening of Jan. 15. The train was beautifully lighted throughout. The plant operated perfectly during the entire trip and gave entire satisfaction.

Kansas City, Kan.—The Consolidated Electric Light and Power Company, of this city, owing to the inability on the part of the Hawkeye Company to furnish them with the plant contracted for, have placed an order through the Western Department of the Excelsior Company, F. W. Horne, Manager, for 150 arc lights. The company will probably increase the number of lights by the addition of 100 more right away.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$149@$152	Iowa Union	23@ 25
Central Union	48@ 49	Michigan	79@ 80
Chicago	300@ 305	Missouri and Kansas	71@ 72
Colorado	40@ 41	Rocky Mountain Bell	39@ 40
Cumberland	65@ 68	Wisconsin	115@ 117
Great Southern	30@ 35		

Plant for the Commercial Deposition of Copper.—In the works of the Chicago Copper Refining Company, at Blue Island near Chicago, Messrs. Leonard & Izard have recently installed an interesting plant for the commercial deposition of copper. The dynamo used is a special one constructed for them by the Edison Machine Works, and has an output of 80 volts and 1,000 ampères. It operates night and day, and gives perfect results.

Novel Scheme for Lighting Street Cars.—A novel plant for lighting the cable cars of the North Chicago Railway Company as they go through the tunnel is now in process of construction. The lamps in the cars will be automatically lighted up when they enter the tunnel, and will be extinguished automatically as they leave the tunnel, by a system on which patents have been applied for. The system originated with Leonard & Izard, who are putting in the plant.

Chicago Electric Club.—The Chicago Electric Club held its regular meeting at the club rooms Jan. 21. The subject of insulation came up again under a motion to reconsider the vote made at the special meeting of the club last week to adopt a certain formula as a standard. After a discussion, in which Professor Badt, Mr. Thompson and others took part, it was decided to continue the discussion at other subsequent meetings of the club, and to put the matter to vote again at the second regular meeting of the club.

Leonard & Izard.—Leonard & Izard have just completed the construction of an electric road for the Thomson-Houston Company, at Alliance, Ohio; also one for the Sprague Company, at Wyatt Park, St. Jo, Mo., and are just finishing work upon the 14-mile road of the Thomson-Houston Company, at Topeka, Kan. They are also at work upon a large number of incandescent central station and isolated plants in other sections of the country, besides being at work upon several large plants for the transmission of power over long distances.

Annual Meeting of the Chicago Edison Company.—The annual meeting of the stockholders of the Chicago Edison Company was held this week, at which the following directors were elected for the ensuing year: E. T. Watkins, A. F. Seeberger, John B. Drake, R. C. Clowry, E. L. Brenston, Robt. T. Lincoln, J. W. Doane, F. S. Gorton, A. A. Sprague, E. M. Phelps, Byron L. Smith. Subsequently Mr. E. T. Watkins was elected president, J. W. Doane vice-president and F. S. Gorton secretary and treasurer. Mr. E. T. Watkins was formerly the president of the Chicago Gas Light and Coke Company, having been most prominently identified with the gas interests for a number of years in this part of the country.

Temperature Regulation.—Messrs. A. M. Butz & Co., Illinois agents of the Consolidated Temperature Controlling Company of Minneapolis, Minn., report the putting in of a number of temperature regulators recently. Among those just put in I may mention one for a residence on Michigan avenue, which is heated by a Baker & Smith Hot Water Heater. From actual tests made and reported, a saving is shown of 50 per cent. in coal, and a variation of only one degree in temperature. The economy of the application of such devices with such a showing is self evident, and illustrates one of the practical applications of electricity, although the current employed is small in comparison with those used for other purposes.

To Regulate Telephone Charges.—A special from Springfield, Ill., dated Jan. 17, says that "the Chicago Telephone Company was assailed from an unexpected quarter this morning when O'Toole, of Lake, introduced a bill in the House which provides that where one telephone is in use by an individual or corporation the rental shall not exceed $2 per month. Where cities, towns and villages are connected by telephone the rate for the use of the same shall not exceed 15 cents for the first five minutes' conversation, and for each additional five minutes no sum exceeding five cents shall be charged. Any owner, operator or agent who shall charge or collect in excess of the rates so fixed shall be deemed guilty of extortion, and shall be fined not less than $50 nor more than $100 for the first offense, for the second offense not less than $100 nor more than $200, and for each subsequent offense shall be liable for a fine of $500. In all cases the right of trial by jury is allowed."

The Van Depoele Electric Manufacturing Company.—This company, I learn, are at present very busy in their various departments turning out apparatus for new installations recently contracted for. As known to most of your readers, the company not long since commenced the manufacture of the Mayo incandescent system. This apparatus, I am told, is more than filling the expectations of the manufacturers, as the special feature of this system is the automatic regulation, which was illustrated in THE ELECTRICAL WORLD of Dec. 29, effected through the construction of the dynamo. In a 100-light machine 99 lights may be thrown off by a single motion of the switch without causing any appreciable change in the remaining light. The company are about to install 500 incandescent lights of the incandescent system at 234 Broadway, New York, the building now occupied by the company as an eastern office, under the management of Edw. E. Britton. This plant, I may say, will form the nucleus of a large central station which the company expect to put in in the immediate future. J. Edgar Jones, formerly with Fairbanks, Morse & Co., has entered the employ of the company as chief engineer, and will have charge of the steam department of the company. Mr. Jones has an enviable reputation as an engineer, and the company through him will be enabled to make the estimates on the entire steam plant in connection with the electrical part, and, if desired, put in the whole plant complete. The company have also secured the services of Mr. Wm. Fay, formerly in charge of the Union Depot station, who will act as salesman for the company, and have charge of the northwestern country. L. L. P.

THE TELEGRAPH.

Mexico.—The government will probably take steps against the railroad telegraph lines, as their charters do not allow them to transmit messages for the public.

Cuba to Yucatan.—The Spanish Government has granted a concession for a submarine cable from Cuba to Yucatan, but the concessionaire will find difficulties there, as it is claimed that the Mexican Telegraph Company's charter gives it the sole right to operate a cable line.

The Spalding Telegraph Company has been formed at Baltimore, Md., with a capital stock of $500,000, to introduce a new system of underground wires for telegraph and telephone purposes, with Henry C. Spalding, of Boston, Mass.; John G. King, Julian G. Alexander, Charles W. Nash and Walter Townsend as directors. Mr. Alexander will be president.

When to Cut the Wires.—A man who got lost in the bush in South Australia resorted to an ingenious expedient for escaping from his dilemma. After wandering about for four days he decided to cut a telegraph line and camp on the spot. His plan worked. The telegraph repairers were sent out along the line to discover the cause of the interruption, and came upon the wanderer in time to save his life.

Cable Rates.—The Anglo-American Telegraph Company has issued a report stating that since the fixing of the rate at 1s. a word for telegrams between England and America the revenue of the company has increased 77 per cent., while its traffic has decreased 26 per cent. The directors of the company are as yet undecided whether or not the rate will be a financial success. So far, however, the results have been satisfactory.

THE TELEPHONE.

New Jersey Legislation.—A bill has been introduced in the New Jersey House of Assembly prescribing the method of procedure when telegraph and telephone companies desire the right to erect poles along the streets in cities and towns.

Anderson, Ind.—The city marshal has been busy removing the telephone poles and wires, because of the company's non-compliance with an ordinance, but he was stopped by an injunction obtained by manufacturers and others, to whom the service is a necessity.

The Telephone Subscribers of New York City held a meeting at the Board of Trade on Jan. 25, in support of the Hamilton bill in the Legislature, reducing rates. Strong resolutions were adopted, and a deputation will be sent to Albany. The Board of Trade claims to have received 700 letters in support of its action.

New England Telephone.—At a meeting of the directors of the New England Telephone and Telegraph Company, held Jan. 23, a dividend of one dollar and twenty-five cents per share was declared, payable on Friday, Feb. 15, 1889, to stockholders of record at the close of business on Thursday, Jan. 31, 1889.

No Discrimination.—Mr. Russell's bill, offered in the New York State Senate, provides that telephone companies shall furnish telephones without discrimination to all reputable parties paying for the same. The object of the bill is to compel telephone companies to furnish their instruments to telegraph and messenger companies.

THE ELECTRIC LIGHT.

Amherstburg, Ont., is to have the electric light.

Green Island, N. Y., has a four years lighting contract open.

Taylor, Tex.—H. J. Mendel and others will put in a 40-light arc plant.

Houston, Tex., will soon have its Fort Wayne Jenney plant, to cost $100,000.

High Point, N. C.—The Empire Plaid Mills have put in an electric light plant.

Marion, Ala.—The new Judson Female Institute is to put in an electric light plant.

Greenville, Tenn.—The Greenville Electric Light Company will soon increase its capacity.

Anniston, Ala.—The United States Rolling Stock Company will, it is said, put in an electric light plant.

Tuscumbia, Ala.—The Thomson-Houston system is to be put in by a company with a capital stock of $6,000.

Gainesville, Tex.—The Gainesville Electric Light and Fuel Company will put in another engine and boiler.

Madison, Wis.—An electric light franchise has been granted to G. W. Gilman, J. W. Hudson and C. Hausman.

Birmingham, Ala.—A Methodist Episcopal College is to be built near Birmingham and is to have electric lights.

Bowling Green, O.—The question of lighting the streets by electricity is now being considered by the city council.

Bessemer, Ala.—The Bessemer Manufacturing Company, T. V. Hoffman lessee, is to put in an electric light plant.

Tuscaloosa, Ala.—Mr. W. A. Jeter is organizing a company with $50,000 capital to build gas and electric light works.

Bridgeton, N. J.—The Ferracute Machine Company, of Bridgton, N. J., has placed an electric light plant in its works.

Liberty, Va.—An electric light and steam plant is to be put in by the Randolph-Macon College. Details can be had from the faculty.

Johnson City, Tenn.—The Johnson City Electric Light Company, having rented power heretofore, will now put in a steam plant of their own.

Canon City, Col.—An electric light franchise having been granted, an opportunity is offered for putting in a plant, and Dr. F. P. Blake may be addressed on the subject.

Augusta, Ga.—The Augusta Thomson-Houston Electric Light Company has been organized with a capital stock of $200,000. Mr. W. H. Fleming is president and Mr. G. J. Fargo, treasurer.

Montgomery, Ala.—The local *Advertiser* of Jan. 20 reports the highly successful starting up of the Westinghouse alternating plant by the Brush Company, of Montgomery, with 400 lights in circuit.

Florence, S. C.—Messrs. George B. Edwards, of Charleston, and Hodges & Newton, of Florence, will put in an exhibition plant with a view to organizing the Florence Electric Light and Power Company.

The Lone Star State.—J. W. Riddle, L. Le Bona, William Hausser, John C. Baylor and others of Eagle Pass, Tex., have incorporated the Texas-Mexican Electric Light and Power Co., with a capital stock of $20,000.

St. Paul, Minn.—The White Bear Electric Light and Power Company has been organized at St. Paul with a capital stock of $30,000. Mr. N. E. Solomon is president; J. Q. Hass, treasurer, and H. T. Hardcastle, secretary.

Must Burn All Night.—Mayor Grant, of New York City, has ruled that electric and other lights put up by private parties for their own use on thoroughfares must burn all night, as a compensation to the public for the privilege of using the street.

Montgomery, Ala.—The Montgomery Gaslight Company has become the Montgomery Light Company. It will do an electric lighting business, the capital stock will be increased to an amount not to exceed $200,000, and 6 per cent. bonds are to be issued.

Lighting a River.—At the annual meeting of the Lake Carriers' Association, at Cleveland, O., on Jan. 23, the project of lighting the Sault Ste. Marie River by electricity was discussed, the majority being of the opinion that it is impracticable to sail that river at night by the aid of electric or any other light.

Lockport, N. Y.—A citizens' meeting has adopted resolutions recommending the introduction of a bill in the State Legislature providing that $30,000 in 4 per cent. bonds be raised to erect an electric light plant for the city. Over 2,000 taxpayers were present at the meeting, to which a committee that has inspected other city plants made a report.

Vermont Figures.—The following 11 villages and cities in Vermont are now lighted with the electric light: Brattleboro, Bellows Falls, St. Johnsbury, Montpelier, Richford, St. Albans, Winooski, Burlington, Brandon, Rutland and Bennington. The cost per light for lighting the streets in Brattleboro is $95, in St. Albans it is $88, in Burlington $86.40 and in St. Johnsbury $65.

APPLICATIONS OF POWER.

Little Rock, Ark.—The City Electric Railway Company will it is said, extend their "dummy road" four or five miles this spring.

Atlanta, Ga.—The East Atlanta Land and Improvement Company have contracted to run their cars on Edgewood avenue by electric power, to be in operation by March 15.

Washington, D. C.—The Rock Creek Railway Company contemplate building an electric railroad three miles long, and will soon commence work. The capital stock is $60,000. Mr. George Truesdell is president of the company.

Waltham, Mass., Electric Road.—A special dispatch from Waltham, of Jan. 23, says: It is now understood that all the shareholders in the Waltham & Newton street railway have transferred their stock to the representatives of the Thomson-Houston Electric Company, thereby giving them full control. It is the intention of the company to run fifteen-minute trips as long as the present line of track is used. It will be some time before remodeling will commence.

PERSONALS.

Mr. Edgar Cate has been appointed superintendent of the electric light plant at Rochester, N. H.

Gen. C. H. Barney has been elected treasurer of the Sawyer-Man Company, to fill the vacancy made by Mr. Lewers, who has resigned.

Mr. W. H. McKinlock, of the Central Electric Construction Company, of Chicago, has been on an Eastern trip with his wife, and spent last week in New York City.

Mr. H. L. Brevoort, of the Roberts-Brevoort Battery Company, has, we regret to learn, been confined at home with a broken collar bone. He has the general sympathy in this unfortunate accident.

Mr. Jesse H. Lippincott gave a very interesting exhibit of the phonograph and graphophone at his company's offices, 257 Fifth avenue, on Jan. 21. The *Commercial Advertiser* says: "It was most astonishing and satisfactory."

Mr. John W. Howell, electrician of the Edison Lamp Company, was married to Miss Mary Cortlandt Drake at Grace Church, Newark, N. J., on Jan. 24. The edifice was crowded with the friends of the happy couple, who have gone off on a month's bridal trip.

Mr. Harold P. Brown has compiled and issued in a neat pamphlet all the various articles, reports, etc., belonging to the recent controversy over the alternating current. He has entitled it: "The Comparative Danger to Life of the Alternating and Continuous Electrical Currents."

Prof. C. Wellman Parks, of the Rensselaer Polytechnique Institute, has been appointed superintendent of the American educational exhibit, to be made at the Paris Exposition. This is an excellent selection. It is understood that the exhibit will be a most interesting display of educational methods and apparatus.

Mr. W. F. Collins, the New England representative of the Callender Company, was in New York last week. He says he is surprised at the extent of the feeling against the old poor kinds of wire for exterior lighting circuits, and at the demand that has thus sprung up for "Trinidad" and the other wires of that class.

Mr. R. W. Hawkesworth, of the Daft Company, is the president of the Orange, N. J., Athletic Club, one of the strongest and most fashionable organizations in New Jersey. The ball given under his supervision last week is described by the papers as having been one of the most notable that ever took place in New York suburbs.

Mr. W. T. M. Mottram, who represents Edison interests in the South, with headquarters at Dallas, Tex., has been in New York for a short holiday, and returned home last week. He reports the electrical outlook in the South as being very bright. Mr. Mottram has recently been at work on some inventions of his own, of which more will be heard later.

Capt. E. L. Zalinski.—A large, well-fleshed man, big-framed and big-headed, brown-eyed and deep as to the forehead, was the most interested of the spectators at Fort Hamilton when Col. Alexander Piper, the commanding officer, opened his parapet to visitors. The large man was more than a visitor, evidently. He moved quickly about with the soft, nimble tread of a tiger, and peered into gun barrels, raised and lowered dynamite cannon, and seemed to be the life of the show. The show was to be an experimental one, the object of the experiments being the pneumatic dynamite torpedo gun. The big, nimble man with the brown eyes and beard and heavy crop of brown hair was no other than Capt. E. L. Zalinski, of the Fifth United States Artillery, so widely known by reason of his dynamite guns as "Lieut. Zalinski." Capt. Zalinski is a native of New York, and has been a soldier all his life. He went into the volunteer service at sixteen, and into the regular army in 1864. He

has been in the artillery ever since. He received his artillery instruction at Willet's Point, the Government's beautiful torpedo station up the sound, just this side of Little Neck, L. I., under Gen. Abbott. As an artillery officer he was naturally interested in high explosives, and he has pursued the subject with a zeal and a success that would probably bring him rapid promotion should a "great war syndicate" undertake to bombard our ports.—*N. Y. World.*

Mr. George Westinghouse, Jr.—George Westinghouse, of Pittsburgh, is estimated to be worth $20,000,000, which he made first by his air-brakes for engines and railroad cars. Every man who travels nowadays pays tribute to Westinghouse. His inventions made fast traveling possible. The quick stopping of a train was next to impossible before his brakes came into use, and hence it was dangerous to run fast and create too great momentum. While talking with Mr. Westinghouse recently he was approached by a gentleman of his acquaintance, who recalled the fact that Mr. Westinghouse had once offered him his brake inventions for the sum of $3,000. Since he founded his enormous fortune Mr. Westinghouse has been interested in various other enterprises, including the natural gas development at Pittsburgh, electric light and motors and railroad building.—*Cincinnati Enquirer.*

MISCELLANEOUS NOTES.

The Columbia Phonograph Company, of Washington, D. C., has been formed, with a capital of $125,000. Mr. E. D. Easton is president.

Execution Machinery.—In the New York State Senate, Mr. Coggeshall's bill, which provides that every State prison shall be provided with the necessary machinery for inflicting the death penalty by means of electricity, has been ordered to a third reading.

The Thomson Electric Welding Company, Lynn, Mass., has welding apparatus machines in full and satisfactory operation at Wallace & Sons, Ansonia, Conn.; Roebling Sons Company, Trenton, N. J.; Trenton Iron Works, Trenton, N. J., and elsewhere. They have received an order from the Ordnance Department, U. S. A., for a machine to be located in the Watervliet Arsenal There is a great demand for the apparatus for welding iron pipe of various diameters. Two-inch pipe can be easily welded within 2½ minutes, and these welds will resist the fumes of anhydrous ammonia, and are therefore rendered more desirable for the manufacture of artificial ice machines and long coils for various purposes.

BUSINESS NOTICES.

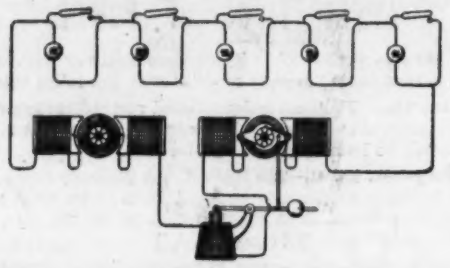
Patterson, Jordan & Gottfried, 146-150 Centre street, carry a complete stock of brass and iron machine and wood screws, cap and set screws, all kinds of bolts, taps, files, twist drills, brass and rubber tubing, brush copper, rod and sheet copper, brass rod, sheet German silver, sheet brass, machinery, tools, hardware, etc. electric motor supplies.

The Reliance Gauge Company, of Cleveland, O., have just received the fifth order from the Dick & Meyer Company, whose sugar refinery is located at Brooklyn, N. Y., for their Reliance safety water columns, and it calls for 15 of the No. 5 combined high and low water alarms, exactly like those furnished some twenty months ago. This refinery first tried these safeguards in October, 1886, and their indorsement in the form of repeated orders, after long continued and constant use, speaks volumes for the appliance, and must be highly gratifying to the manufacturers.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED JANUARY 22, 1889.

396,403. Electric Meter; M. J. R. Jacquemier, Paris, France. Application filed Aug. 20, 1888. The invention is designed to operate under the following conditions: At regular intervals of time a movable part or detector undergoes a displacement depending upon the intensity of the current which is passing in the circuit. To each displacement of this movable part or detector corresponds an advance of the wheel work of the integrator, which advancement is proportional to the intensity of the current. The



396,602. COMBINATION OF ELECTRIC GENERATORS.

graduations of the integrator are such as to indicate the quantity of electricity passed during the successive and uniform intervals of time at which the integrator is set in movement.

396,407. Electric Wire Conduit; John Lynch, Washington, D. C. Application filed Nov. 5, 1888. A rectangular terra cotta conduit pipe having rectangular partitions, all of uniform thickness and made in one integral piece.

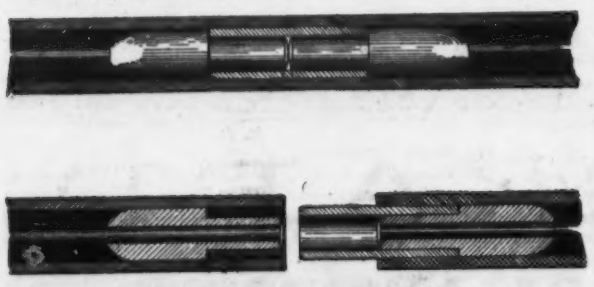
396,422. Regulation of Alternate Current Generators; Gustav Pfannkuche, Cleveland, Ohio, Assignor to the Brush Electric Company, of same place. Application filed Nov. 5, 1887. Claim: The combination with an alternating current dynamo, of a separate exciting dynamo having its field magnets provided with two sets of coils, one set being included in the circuit of the field magnet coils and the alternating current dynamo, and the other set being included in a shunt across the brush terminals of the alternating current dynamo. See illustration.

396,439. Electrical Switch; E. A. Sperry, Chicago, Ill., Assignor to Herbert E. Goodman, Boston, Mass. Application filed Nov. 23, 1886. Claim: The combination of a main line with a service loop theron, a duplex switch whose arms complete the connections with the main line, a differential magnet through which the loop current passes in opposite directions, a retracting spring connected with such switch, and a catch to hold such switch, said catch controlled by the magnet, so that when released it opens the switch and permits the loop to be cut out of the main line.

396,549. System of Electrical Distribution; E. N. Dickerson, Jr., New York, N. Y. Application filed Nov. 7, 1887. Claim: The system of electrical conversion herein described which consists in causing a direct current to flow upon the line wire in locally reversing the same by a reverser independent of the generator, the said reverser being driven by the electricity generated in the main generator, in causing the said reversed current to flow through a converter, thereby producing a series of secondary reversing currents and in rectifying said currents through a second reversing commutator moving synchronously with the first commutator.

396,450. Municipal Telegraph System; T. J. Zoeller, Louisville, Ky., Assignor to the United States Signal Clock Company, of same place. Application filed Jan. 2, 1888. Claim: The combination with an electric circuit and slowly and rapidly operating circuit breakers or transmitters therein, of a primary and a secondary relay located at a given station, a register and an indicator, and local circuits, those containing the register and secondary relay being controlled by the main or primary relay alone, and that containing the indicator being controlled conjointly by the main and secondary relays and the register.

396,465. Sounder Attachment; G. H. Carey and William McArthur, Dollarville, Michigan. Application filed March 1,



396,543. UNDERGROUND SYSTEM FOR ELECTRIC WIRES.

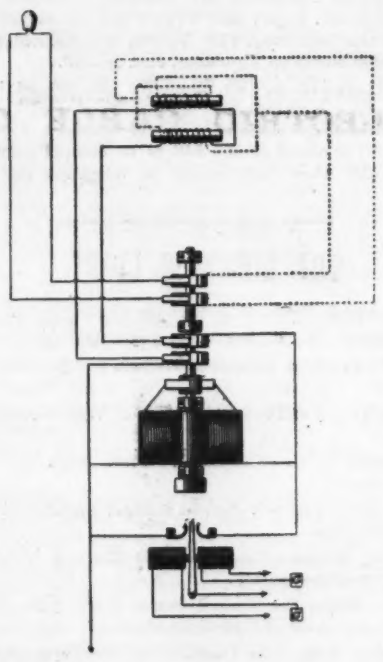
1888. The invention consists of a box of resonant material supported over the armature lever in position to receive the blows of the said lever.

396,543. Underground System of Electric Wires; Henry B. Cobb, Wilmington, Delaware. Application filed April 19, 1888. The object is to provide a form of joint between the main wires and coupling wires connecting with them which shall produce the necessary metallic contact between the wires and at the same time afford the requisite insulation and imperviousness at the joints. See illustration.

396,557. Dynamo for Telegraphic Purposes; B. Gmuer of Schaenis, and Otto Flatz, of Niederurnen, Switzerland, Assignors of one-half to B. Deisenberg, of Travnik, Bosnia, and Joseph Gmuer, of Schaenis, Switzerland. Application filed June 9, 1888. The invention consists in the combination of a dynamo or magneto electric machine especially designed and wound for this purpose, with a weight motor provided with a hoisting mechanism. The telegraph operator is enabled by this contrivance to effect a constant traction on the dynamo or magneto electric machine by his personal labor and without being hindered in his other duties, and he can by these means generate a current for telephonic and telegraphic purposes instead of by using galvanic batteries.

(1) 396,579. (2) 396,580. (3) 396,581. (4) 396,582, and (5) 396,583. (1) Wiring-Block for Electrical Circuits; (2) Coupling Dynamos; (3) Coupling Dynamos and Motors; (4) Automatic Ground Detector for Electric Circuits; and (5) Incandescent Lamp Socket; Osborn P. Loomis, of Somerville, Mass., Assignor to the Loomis Electric Manufacturing Company, of New York. Applications filed respectively Aug. 17, 1887, Sept. 13, 1887, April 19, 1888, Aug. 7, 1888, and Sept. 3, 1888. (1) The invention consists of a wiring-block preferably supplying both sides of the main wires, and includes a fuse in each circuit, which is inserted therein in a simple manner and is of small expense. (2) The invention consists of electromagnets arranged in the circuits emanating from the dynamos to the main circuit, which magnets control contact devices to so modify the magnetizing effect of the coils of the dynamos as to keep each one at its constant of work. (3) The invention consists in a new way of connecting the coils and circuits of the dynamos together; also, a novel form of switch for making the said connections. (4) The invention consists in a ground wire connected, at preferably the central station, to a wire in electrical communication between the two parts of the circuit, in which ground wire, or in the connection between the two parts of the circuit, or in both, may be placed one or more devices to indicate when a portion of the current is passing over the ground wire, which would occur only when the circuit was grounded at some point. (5) The invention relates to an incandescent electric lamp having an improved socket piece coupling, for coupling the lamp together, and at the same time connecting the lamp terminals to line, the coupling consisting in a post projecting from the lamp stem, and carrying the lamp terminals, which are connected with the leading in wires, and formed with suitable tranverse corrugations.

396,602. Combination of Electric Generators; E. W. Rice, Jr., Lynn, Mass. Application filed Oct. 28, 1887. A method of furnishing a regulated current from a number of dynamo generators, consisting in keeping one or more of said generators con-



396,549. SYSTEM OF ELECTRICAL DISTRIBUTION.

stantly at work supplying a definite or fixed amount of electricity to the circuit, and regulating the remaining generator to adapt the total current supply to the demand of the circuit.

396,603. System of Electrical Distribution; E. W. Rice, Jr., and A. L. Rohrer, of Lynn, Mass. Application filed July 26, 1888. Claim: In a station apparatus for alternating current systems of distribution, a double pole switch placed between the generator and the mains, and a branch between the mains connected thereto at the opposite side of the double pole switch from the generator, said branch containing potential indicating appliances, all as shown, whereby on operation of the switch both the mains and the potential indicator are severed from connection with the machine at both terminals.

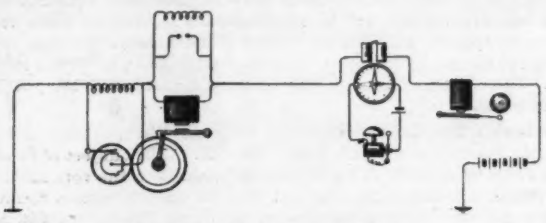
396,618. Electric Railway Trolley and Support; Sidney H. Short, Columbus, O. Applications filed Nov. 8, 1888. A spring support for the trolley rod, consisting of a pair of springs attached to suitable caps and arranged one in front and the other in the rear of the axis of the trolley rod, whereby one is made to act under tension and the other under compression.

396,632. Time Switch; Benj. E. Waters, Brockton, Assignor of one-half to Moses E. Hatch, of New Bedford, Mass. Application filed April 9, 1888. The invention consists mainly in a motor, the operation of which is governed by an electro-magnet, the circuit of which is controlled by the hour hand of a clock, said motor operating an electric switch or equivalent device, and being constructed to change the position of the circuit controlled by said switch at two consecutive operations, but to produce no substanti l change in the said circuit at the next two operations of the motor, which are, as it were, idle movements. Thus, by arranging the clock circuit closers to close the circuit at two given moments—such, for example, as at the beginning and end of the evening—the first such closure will cause the switch to be closed, the next such closure at the clock will cause the switch to be opened, and the next two closures that take place in the next forenoon will be idle or produce no operative effect upon the switch, which will, however, respond in like manner to the two closures of the clock-controlled circuit occurring the following evening.

396,633. Electric Railway System; David G. Weems, of Baltimore, Maryland, Assignor to the Electro Automatic Transit Company, of Baltimore City, Maryland. Application filed June 14, 1888. In an electric railway system for transporting mail and packages, the combination, with the upper and lower rails and stops on the line of road, of an electrically operated car, means for conveying the current thereto, and adjustable housings on the car having levers, which are actuated by the stops.

396,645. Electric Time Meter; Geo. F. Card, of Covington, Kentucky. Assignor to the George F. Card Manufacturing Company, of Cincinnati, Ohio. Application filed Sept. 12, 1888. It consists in a clock mechanism in combination with an electro-magnet attached to the electric circuit, and so arranged that the electric currents will control the movements of the clock, so as to record the time the current is in use. It may be arranged so that when the current of electricity is flowing the clock will stop, a dial being connected with the clock which records the time during which the clock is going; or the electro-magnet may be so arranged that the clock will go only when the current is on.

396,667. Burglar Alarm; Arthur C. Robbins, Brooklyn, N. Y., Assignor to William S. Andrews, of New York, N. Y. Ap-



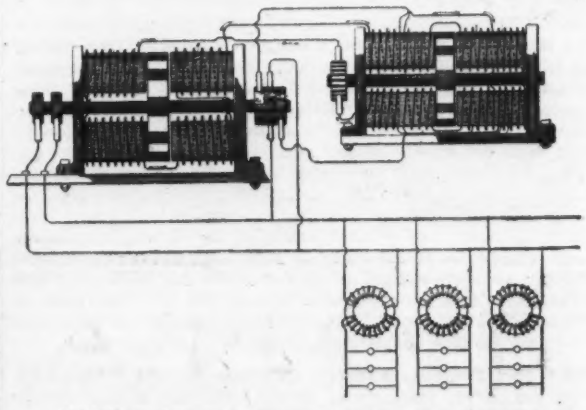
396,667. BURGLAR ALARM.

plication filed Sept. 22, 1887. The system embraces a closed circuit including a magnet and a resistance. A normally open short circuit is located around the resistance and includes a transmitter. The magnet in the main circuit controls the transmitter. There is also a closed shunt circuit around the magnet, and a resistance in the shunt. The apparatus at the central station consists of a receiver for the indications sent by the transmitter and also an instrument for receiving and indicating changes in the resistance of the circuit. See illustration.

396,681. Secondary Battery Charging; Charles F. Brush, Cleveland, Ohio. Application filed May 21, 1883. The invention relates to devices for regulating the charging and discharging of secondary batteries. The devices for this purpose are such that, first, when no current is acting the charging circuit, the one or more batteries in connection therewith will be open circuited, and the latter will be short circuited around each battery; also, second, when the charging current is fully established in the charging circuit or line, the short circuit around each battery will be opened and the battery throw into circuit; also, third, when each battery becomes fully charged, it will, independently of any other battery in the charging circuit, be thrown out of the charging circuit, and the latter will be short circuited around the battery as at first; again, when the charging circuit stops or becomes greatly lessened, each battery, whether fully charged or not, will be thrown out of circuit and the line short circuited as before.

396,688. Mechanical Telephone; Thomas S. Davis, of Cape Girardeau, Missouri, and William W. Davis, of Lawrence, Kansas, Assignors of one-third to Thomas Johnson, of Cape Girardeau, Missouri. Application filed July 14, 1888. The invention relates chiefly to the adjustment of the telephone box to a wall-bracket by means of a steel spring and adjustable eccentric blocks, so that the conducting wire which is attached to the diaphragm of the telephone is always taut in the extremes of temperature of summer and winter, and also that tension of conducting wires is equalized by the steel spring, thus obviating the continued breaking asunder and tearing of conducting wires.

396,701. Burglar Alarm; G. B. Lehy, Medford, Assignor of one-half to B. J. Noyes, Boston, Mass. Application filed April 14, 1888. It consists in the combination with a pendant attached to a spring-actuated or spring-controlled shade or curtain, of a pivoted



396,422. REGULATION OF ALTERNATE CURRENT GENERATORS.

circuit-changing lever engaged by said ring and held in its normal position.

PATENTS EXPIRED JANUARY 30, 1889.

123,198. Insulator; J. Robertson, Carbondale, Pa. Patented Jan. 30, 1872. The insulator consists of a block provided with a diagonal groove extending from the edge of the same to a chamber in the middle. The wire is inserted into the chamber through the groove.

123,315. Electro Magnetic Stop Motion for Knitting Machines; H. E. Wells and D. H. Moran, Van Wert, Ohio. Patented Jan. 30, 1872. This patent covers a construction whereby the breaking of a thread will cause two magnets to fly apart and stop the machine.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Potter Building, N. Y.